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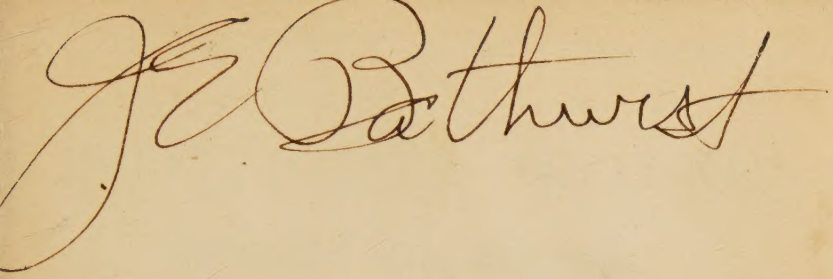

J. E. Bathurst

INTELLIGENCE TESTING

METHODS AND RESULTS

BY

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J. E. Bathurst

PREFACE

This book is an attempt to give a simple account of intelligence testing and the results which have so far been achieved by the testing movement. It is designed for use as a text in a college course, and it is hoped that it will prove useful in serving as a guide to the thousands of teachers who are now becoming interested in the use of intelligence tests in their schools.

The book is not a treatise on measurement in education or psychology. For this purpose, we have already the valuable works of Thorndike, Rugg, and others. Nor does it deal with the technique of test construction, which has been recently covered by McCall. Furthermore, it does not deal with educational tests, that is, with tests of achievement in school subjects, for in this field there are now many books. It is rather an attempt to tell the reader what is meant by intelligence testing, what means are employed to test general intelligence, and what results have been achieved.

Part One is mainly historical and theoretical in nature. It shows the gradual evolution of the intelligence test and discusses some of the basic assumptions underlying the work.

Part Two is a description of the various tests, individual and group, that are at present available. It aims to give the student a survey of the various methods by means of which intelligence is tested. The classroom instructor will supplement here by giving or dem-

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onstrating to his class the different types of tests. In some classes practical work with the tests in schools will be feasible and desirable.

Part Three summarizes the main results of intelligence testing. Up to the present time this material has been scattered in numerous periodicals, monographs and books. Many of these are inaccessible to the student. The author has attempted to bring this material together and indicate what conclusions can be drawn at the present time. The numerous references in this section may be utilized by the instructor as assignments for further study by his students.

Bibliographical references follow each chapter. These are arranged in alphabetical order according to the name of the writer. In the text, the date of publication of the work referred to is put in parenthesis after the writer's name.

Throughout the book the influence of Thorndike's work will be obvious to the student. No one man has had more to do with stimulating the measurement movement in this country than Professor Thorndike. It is fitting, therefore, that the author should acknowledge his indebtedness in this place, both for the inspiration received from Professor Thorndike's writings and for his personal advice and encouragement. He also wishes to acknowledge the very valuable help rendered by Professor Peter Sandiford of Toronto University, who read the original manuscript and made many important suggestions. Also, he takes pleasure in acknowledging here the great assistance rendered by his wife in preparing the manuscript for the printer and in seeing the book through the press.

Intelligence testing is of recent growth, and the ac-

complishments of the last fifteen years have been great. Nevertheless, we stand merely at the beginning of an important chapter in the measurement of human behavior. The future will see new and more accurate tests. It will see tests applied for purposes now unthought of. The types of individuals tested, which form the chapter headings of Part Three, will undoubtedly increase in numbers. A future edition of such a book as this may well have such chapter headings as "The Immigrant"; "The Voter"; "The Applicant for a Marriage License"; "The Candidate for Public Office"; "The Civil Servant"; and so forth. For intelligence is one of the aspects of an individual's personality that is of great importance in modern civilized life. And now that we are able to measure it with a fair degree of accuracy, intelligence tests will find a wider and wider field of application.

R. PINTNER

NEW YORK,
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PART I

HISTORICAL AND THEORETICAL

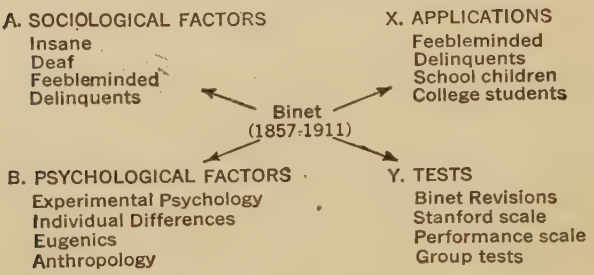
CHAPTER I

EARLY HISTORY OF INTELLIGENCE TESTING

Although the intelligence test, as we know it today, is of recent growth, it is, nevertheless, interesting to trace its early history, and to find some of the causes which led to its development. Like so many of the results of modern science, the intelligence test may be said to have appeared as the fulfillment of a need that existed. It came to supply a want in society. And the science of psychology had progressed far enough in the problem of mental testing to be ready to fill this need when the time came. We may thus think of these two aspects, the theoretical interest and the practical need, and we may further consider them as brought to a focus in the work of Binet, as exemplified by his construction of the Binet-Simon Scale. Let us call the theoretical interest in the problem the psychological interest and the practical interest the sociological interest. The following diagram will help to illustrate this presentation of the subject.

The left side of our diagram represents the forces, practical and theoretical, leading up to the work of Binet, and the right side the modern development of the work, which we have represented as brought to a focus by Binet. The upper half of the diagram represents the practical field, and the lower the theoretical.

The sociological trend stimulated the psychologist to devise means to fill the needs of society and once these means were supplied, we see the application of these to many different groups of individuals. The psychological trend gave the psychologist the tools with which to work and once these were adapted to the new demands,



we see an extension of these kinds of tools in the shape of innumerable scales and tests, a few of which only we have indicated in our diagram.

By bringing these trends to a focus in the work of Binet, we do not mean to suggest that he was the only worker in the field, nor that his influence was the only influence leading to the development of scales for mental measurement. There were many workers and many currents of interest, so many, indeed, that our diagram would become too complicated if we tried to include them all. It was, however, the work of Binet during the years 1905 to 1911, around which the main interest centered, and it was his scale that first won universal recognition as a practical means for the measurement of mental ability.

In this chapter we shall trace briefly the two influences, the sociological and the psychological, that led to

the establishment of scales for the measurement of intelligence. The work of Binet and of the other workers who followed him, and the results of the application of their tests will be taken up in succeeding chapters.

A. The Sociological Trend

By this we mean those forces in society directing our attention to the defective and delinquent classes. These classes first aroused the interest of the psychologist because of their peculiarities in mental make-up. This is particularly true of the feebleminded, and the application of the first scales for measuring intelligence was largely restricted to them. It might be well, therefore, to trace briefly the attitude of society towards this group of individuals.

Ancient Period. — We have little information as to the feebleminded in ancient Greece and Rome. Exposure of undesirable children was practised and at certain periods and in certain places was common. In general the obviously physically defective were exposed, and, to the extent that feeblemindedness is accompanied by physical defect, the feebleminded would thus be eliminated. The great mass of feebleminded, sound in body, would escape. During the period of the Roman Empire exposure was not so common, and the cynic has suggested that, had the old Roman custom more commonly prevailed, the world might have been spared the excesses of a Nero or a Commodus.

Medieval Period. — The emphasis of Christianity upon charity and mercy caused a decided change in the attitude of society towards the physically and mentally defective. All classes of the "despised and re-

jected " were cared for in asylums by the Church. This attitude was marked by sympathy and pity, but was absolutely lacking in understanding or in helpful service. The insane and feebleminded were tolerated and in many cases regarded with a sort of religious awe. They were supposed to be under the special protection of God, and the ravings of the " fool " were sometimes taken for divine revelations. This religious reverence is well expressed in the French " enfants du bon Dieu," and in the term " innocents " as used in Scotland and Ireland. Later on the " fool " graduated into the " jester," and this position was often filled by men of high intellectual attainments.

During this period the laws of England differentiate between the idiot (*idiota a nativitate*) and the lunatic (*idiota a causa et infirmitate*). In an old law book, " The New Natura Brevium," by Sir Anthony Fitzherbert, published in 1534, we find the following suggestion of primitive intelligence tests: " And he who shall be said to be a sot and idiot from his birth, is such a person who cannot account or number twenty pence, nor can tell who was his father or mother, nor how old he is, etc., so as it may appear that he hath no understanding of reason what shall be for his profit, nor what for his loss. But if he hath such understanding, that he know and understand his letters, and do read by teaching or information of another man, then it seemeth he is not a sot nor a natural idiot."

The Renaissance. — The emphasis of Protestantism upon the individual and upon his individual responsibility for his deeds and misdeeds, caused a sudden change in the attitude of society towards the feebleminded and insane. Far from being considered the

special protégés of the Deity, they are now regarded as the children of Satan. They are possessed of devils and strenuous treatment must, therefore, be applied to drive out the devils. What they do, they do intentionally and of their own free will, and, therefore, they must be chastised for their misdeeds. So the insane and feebleminded who offend are whipped and bound in chains and cast into dungeons until such time as they reform. This period has been well called "the era of whips and chains."

The industrial revolution of the 18th century produced a great demand for child labor. The condition of the child mill-worker in all industrial centers was pitiable. An interesting reference to the feebleminded appears in the custom, prevalent in England in the 18th century, of binding out pauper children to the mill owners. "The parish authorities, in order to get rid of imbeciles, often bargained that the mill-owners take one idiot with every twenty children. What became of the idiots is not known, but in most cases they did not last long and mysteriously disappeared." (Payne, 16.)

Modern Period. — Gradually the modern attitude developed, characterized by a scientific interest in the insane and feebleminded, and also by a deeper sense of social justice to all classes. The fight for the better treatment of the insane was prosecuted vigorously during the nineteenth century. It directed the attention of physicians and psychologists to this class and one of the results was the beginning of a real study of insanity. As this went on, the interest was extended to the feebleminded and the present era of enlightened care and definite study of feeblemindedness was begun.

The Deaf. — Excluding from consideration the charitable asylums that were found in early times and in the middle ages, caring for the outcasts and the defectives in general, we may say that, of children who are not entirely normal, deaf children were the first to attract the special interest of the educator. The affliction of deafness is more striking and more dramatic than the afflictions of blindness or of feeblemindedness. The uneducated deaf and, therefore, dumb child is so utterly unlike the normal hearing child as to arrest attention at once. He has no means of communication with his fellows and cannot say the simplest words, a condition that is only approached by a very low grade idiot, whereas in other ways he shows signs of intelligence much above the idiot. Again the crude attempts of the deaf to communicate with others by means of simple natural signs must have suggested to the educator a simple means of instruction that needed only to be enlarged and systematized.

Ponce de Leon (1520–1584) is credited with being one of the first to educate the deaf by signs and also by oral speech. In the seventeenth century Juan Pablo Bonet is supposed to have invented a manual alphabet from which that now used in the United States is descended. In the eighteenth century Pereire in France revived Bonet's alphabet and taught lip-reading and speech. The Institution for Deaf Mutes in Paris was founded by the Abbé de l'Epée (1712–1789), and the methods employed in this school were later on studied by T. H. Gallaudet and brought over to America. He became the head of the first school for the deaf in this country, the American Asylum for the Deaf and Dumb at Hartford, Connecticut, founded in 1817.

The Blind. — After the work for the deaf was well started it was natural that the interest of educators should extend to the blind. Haüy in France began definite constructive work in 1798. Very soon this line of work extended to several countries and Dr. Howe in Boston was the first superintendent of the Perkins Institute for the Blind founded in 1833.

Interest being thus directed toward abnormal children, it could not be long before the mentally defective child, as contrasted with those suffering primarily from the physical defects of blindness and deafness, would claim attention. It is a fairly safe conjecture to suppose that in the actual work with the deaf and the blind the problem of mental defect would arise, and we know that idiots and imbeciles were sometimes admitted to deaf and dumb asylums. The interest of the educators, however, was rightly centered on the handicaps of deafness and blindness, and it was, therefore, left for a more dramatic incident to turn the attention of scientists to the problem of feeblemindedness itself.

The Feebleminded. — In 1797, a so-called wild boy was found by some hunters in the woods of Caune, in the Department of Aveyron in France, and was brought to Paris, where he aroused considerable interest. He is known in our literature as the wild Boy of Aveyron (*Juvenis Averionensis*), and we may consider him the first feebleminded child whose education was scientifically attempted. That he was an imbecile was not admitted by many of the scientific men who studied him, although Pinel suspected this to be the case. Pinel was Physician in Chief to the Bicêtre in Paris, a charitable institution or foundling hospital, founded by St.

Vincent de Paul, caring for the feeble in mind and body. The boy, however, aroused the interest of the followers of de Condillac, the sensualist philosopher, and they imagined that here would be an admirable opportunity to watch the effect of sensations upon ideas in the gradual transition from savagery to civilization. There was no one more fitted to undertake this task than Itard, the philosophically-minded physician of the Institution for Deaf-Mutes. Itard was familiar with what had been accomplished by Pereire and de l'Epée, and was daily in touch with the work of Sicard at the deaf school. He was well qualified, therefore, to make good use of the methods of education that were being used with the deaf.

Itard worked hard and accomplished much but could not restore the boy to complete normality. When it dawned upon Itard at last, that the boy was an imbecile or idiot, he threw up his work in despair. He shared the common medical belief that idiocy was incurable and that idiots were "human brutes" separated by a great gulf from the normal, and, therefore, once sure of a diagnosis of idiocy there was nothing to do but to send the boy to the Bicêtre as a custodial case unworthy of training. Itard failed to see that, although the boy was an idiot or imbecile, his course of training had been of great good to him and had made him less of a burden to society than he had been before.

Seguin. — The great step in advance made by the method of education followed by Itard and the great fact of the improvability of the feebleminded was seen and appreciated by Seguin, the pupil of Itard. He had watched with interest the experiment of his mas-

ter and he carried on the work from the point where Itard abandoned it. In 1837 Seguin commenced the training of a few cases of feebleminded children. In 1842 Seguin convinced the authorities of the desirability of educating the idiots and imbeciles at the Bicêtre and he was put in charge of the school there. This marks the beginning of state schools for the feebleminded. From this time on the State recognizes the necessity for training these individuals in addition to merely housing and feeding them.

Seguin is also important in our history because he is the author of the first standard book dealing with the education and treatment of the feebleminded. His book, "Traitment moral, hygiène et éducation des idiots," was published in 1846, four years after he commenced his work at the Bicêtre. This book has been well called "the emancipation proclamation for the fettered soul of the idiot" (Johnson, 95). There is much in it that we do not agree with at the present time, but on the other hand it shows a marvelous insight into many of the aspects of our subject. We do not agree with the sharp distinction that he draws between idiocy and imbecility and between both of these and backwardness, but his plea for the regulation of marriage to restrict the propagation of the feebleminded shows that he appreciated as well as we do in the twentieth century the importance of the factor of heredity. The whole book is written in an aggressive style and many passages are directed against the ignorance, apathy and conservatism of the medical profession. He feels keenly that the medical profession as a whole is not as actively interested in the problem of the feebleminded as it should be, and that their conservative atti-

tude and their pretence of knowing all about it stands in the way of progress. Seguin's whole life was devoted to work with the feebleminded and by coming to America in 1848 he stimulated directly the work in the United States. While in this country he published in 1864 his English book, "Idiocy: Its Diagnosis and Treatment by the Physiological Method."

In other countries as well as in France, attention was being directed toward the feebleminded, and England, Germany and Switzerland soon took up the work. The first state institution for the feebleminded in America was opened in Massachusetts in 1849. New York followed in 1851, and from this time onward up to the present time we have a record of the opening of one institution after another. The great majority of countries now fully recognize the duty of making some kind of provision for the mentally defective.

Special Classes. — Commencing a little later than the establishment of institutions and much slower in making headway, was the movement for the separation of the backward and dull children into special classes in the public schools. The first special class was started in Halle, Germany, in 1859, with the idea of stimulating the child in order to put him back into the regular classes. This idea existed for some time, but finally had to be abandoned as the classes gradually filled up with feebleminded children who could not keep pace, let alone catch up with the regular classes. In the United States, the first special class for backward children seems to have been organized in Cleveland in 1893 (Mitchell, 16). Although the first classes were started only shortly after the opening of the first institutions, it was not until the first decade of the twentieth cen-

tury that the special class became a common feature of the ordinary public school system.

Psychological Clinic. — We thus see a growing interest during the nineteenth century on the part of the social reformer and the educator in the care of the feebleminded and it is towards the end of the century that we notice the first definite interest on the part of the psychologist. This is typified by the opening of the Psychological Clinic in the University of Pennsylvania in 1896 under Dr. Lightner Witmer. Here for the first time we see the emphasis placed upon the necessity of a careful psychological diagnosis of the nature of the mental deficiency together with an attempt to treat such deficiency as far as it may be amenable to treatment (Witmer, 07). Let us, however, retrace our steps for the time being in order to follow other influences in psychology which were leading up to the development of clinical psychology and the measurement of mentality.

B. The Psychological Trend

If we trace the influence in psychology and allied sciences that led to an interest in mental testing, we can for convenience distinguish four lines of approach: (1) experimental psychology; (2) the study of individual differences; (3) the growth of eugenics and (4) anthropological measurement.

1. *Experimental Psychology.* — The growth of experimental psychology from the opening of Wundt's laboratory in Leipzig in 1879 was very rapid. The apparatus and methods of physiology and physics were pressed into the service of the new science. The main interest centered upon a study of the general laws of

the normal human mind, and, in arriving at these, the differences between the different individual observers acted as disturbing factors. It was not long, however, before these differences became in themselves of interest. This is, perhaps, best seen in the study of reaction to a visual, an auditory, a cutaneous or some other kind of stimulus regardless of the observer's own peculiarities. The differences between observers, however, soon led to the study of different types of reaction, and we have then the many studies dealing with so-called sensory, motor and mixed types. It can readily be seen, therefore, how at an early date a study of individual differences themselves was bound to arise.

Before proceeding to touch on this factor, we may note an outgrowth of German experimental psychology that indirectly helped the growth of clinical psychology. This was the carrying over of the apparatus and methods of the psychological laboratory into the psychiatrist's examining room. The German psychiatrists were more influenced than those of any other country by the new experimental psychology, and many of them received a thorough training in the psychological laboratory. Kraeplin, Sommer and Ziehen are the outstanding names and the work they did was essentially the application of the methods of experimental psychology to the study of insanity. Although this work contributed interesting facts to our knowledge of the psychology of insanity, it failed to give us any new viewpoint, such as the Freudian conception of the abnormal mind or Binet's concept of general intelligence and the possibility of its measurement.

2. *Individual Differences.* — We have seen how a study of individual differences arose out of the work in

the psychological laboratory, and in the last decade of the nineteenth century a great many studies appeared. In this country the work was championed by Cattell and it would seem that we are indebted to him for fixing the word "test," as denoting a simple task to be performed by subjects in the investigation of individual differences. Already in 1890 we find him writing on "Mental Tests and Measurements," pleading for standardization of methods of procedure, and urging the necessity for the establishment of norms.

Very few of the tests described by Cattell are tests of general intelligence; they are mainly sensory and sensory-motor tests. Nevertheless, we see here a beginning of the type of work that led later to intelligence testing. In 1894 Cattell began testing the students of Columbia College during their first and fourth academic years, and thus began the testing of Columbia students, which has culminated in the work of Thorndike at the present time. In 1896 Cattell and Farrand published the first results of these tests. About one hundred students were given tests of vital capacity, strength of grip, vision, reaction time, pain, memory, imagery, etc. The authors urge the adoption of these tests and that they be given in a standard way by all psychological laboratories.

In this same decade we have other articles showing how the interest was growing and how the idea was expanding. Bolton (92) gives memory tests for digits to a great many children, studying the growth of memory and comparing the results in memory with the intellectual acuteness of the children. To be sure the "intellectual acuteness" is merely based upon the judgment of the teacher, but it is already becoming a factor in the study of individual differences.

Again it is interesting to note an article by Bourdon (95) because it contributed a test that has since been widely used. Bourdon's interest was philosophical rather than practical. He was studying the rate and time of perception and in so doing he used the cancellation of one letter on a printed page as a test for his observers. He calls it a test of discrimination. This seems to be the first use of a cancellation test, a type of test that has been used extensively and one that lends itself to infinite variations.

Johnson (95) shows how the influence of the Child Study Movement, stimulated by Stanley Hall, was spreading over to an interest in feebleminded children. His work is historical, pedagogical, and observational in character, but also includes several psychological tests. The performances of feebleminded and normal children on the tests are compared. He has no adequate norms for ordinary children, but his work was pointing the way to the necessity for standards.

In Sharp's (98) work we see the direct influence of Binet and Henri in the application of certain tests in memory, imagery, imagination, attention, etc., to about eight students. We shall reserve for a later section a description of the work of Binet, but it is interesting to note at this early date the influence of his work, and this we must remember is long before the publication of the Binet-Simon Scale.

By 1900 we note the interest extending to the testing of school children. Kirkpatrick tests 500 children with tests of counting aloud, making vertical marks, sorting cards, interpreting inkspots and so on. The results of these tests are compared with the grades given the children in school work. There is no elabo-

rate attempt on the part of the author to be concerned with just what mythical faculty of the mind each one of his tests seems to be testing. He is anxious to see in a general way whether these tests are indicative of good accomplishment in school work. He feels greatly the need of standards and makes a beginning of standardization by age.

The work of testing students under Cattell's direction was going on all this time at Columbia University and in 1901 we have a report by Wissler (01) of some of the results in a study of the correlation between the more particularly mental and the more decidedly physical tests.

In 1903 appeared one of the most interesting articles prior to the Binet Scale. This is Kelly's article on "Psycho-physical Tests of Normal and Abnormal Children." It is interesting chiefly because he clearly states as his purpose the attempt to find a simple method of differentiating between normal and abnormal children. His tests are largely physical, and he feels keenly the need of norms. He finds in general an increase in motor co-ordination as intelligence increases; also the lower the intelligence, the more prominent the element of fatigue.

The most significant work in this country, before the appearance of the Binet Scale, is undoubtedly the tests of feebleminded children conducted by Norsworthy (06). At this early period we find her giving what are, in essence, group tests of intelligence and expressing the standing of the child in terms of the variability of the group. This is really what many group tests are doing at the present time.

We see, therefore, from this survey of a few of the

studies in individual differences that were appearing at the beginning of the twentieth century, that interest was being aroused in the possibility of the measurement of intelligence and that the time was ripe for the work of Binet.

3. *The Eugenics Movement.* — Another great stimulus to the study and measurement of individual differences came from the Eugenics Movement. This movement was started and fostered by Sir Francis Galton, one of the most versatile of British scientists in the latter half of the nineteenth century. His book "Hereditary Genius," published in 1869, begins with the following significant sentence: "I propose to show in this book that a man's natural abilities are derived by inheritance, under exactly the same limitations as are the form and physical features of the whole organic world." This emphasis upon "natural abilities" or mental traits is for us the important thing, because attention could not long be focussed upon the inheritance of such abilities, without the necessity soon arising of some method of evaluating or measuring the amount of such abilities that may be inherited. Indeed, in this very first book of Galton's we find him constructing an imaginary scale for the measurement of general ability. This imaginary scale is based upon the theory of a normal distribution and ranges from the lowest idiot to the highest genius. Here Galton introduced a valuable quantitative concept, and began the breaking-down of the commonly accepted idea of the existence of specific types, such as idiots and geniuses. People differ from each other in general ability by measurable amounts and cannot be grouped into several distinct and specific types.

Galton elaborated this idea of a scale and divided it into fourteen grades. He assumed without objective tests that races varied in intelligence, and he suggested that negroes are very probably two grades below whites. The highest race or group he considered the Athenians of classical times and he placed them two grades above modern Europeans.

In all Galton's work we note this interest in the measurement of ability, although he himself did not devise any specific tests for it. His idea of general intelligence has certainly had influence upon psychological thought and it is in many respects very much like the ordinary psychological conception at the present time. For instance, in his "English Men of Science" (74) in discussing the presence or absence of what he calls the innate tendency for science, he says, "Nay, further, it appears that of the men who have no natural taste for science and yet succeed in it, many belong to gifted families, and may therefore *be accredited with sufficient general abilities* to leave their mark on whatever subject it becomes their business to undertake."

In 1884 Galton founded his Anthropometric Laboratory for many different types of measurement and it is interesting to note that reaction time is found among his list of tests. In the mathematical handling of the data he expanded the idea of percentile grades, suggested to him by the work of Quetelet. Later on, in 1886, he introduced and applied the coefficient of correlation in a simple form. About 1901 we note the founding of the Biometric Laboratory by Karl Pearson in University College, London, and in 1905 the founding of the Eugenics Laboratory by Galton.

These events mark the firm establishment of the con-

cept of mental measurement, and the work of the British Biometric School has contributed greatly to the mathematical handling of data and particularly to our understanding of the theory of correlation.

4. *Anthropological Measurement.* — Our fourth and last line of approach we shall deal with very briefly. The field of anthropology is, of course, very vast and the number of different kinds of measurements made by anthropologists very great. Only the measurements of the skull, however, interest us here. It was inevitable, when such measurements were made, that interest should be aroused as to the abilities of the individuals measured. Head measurements of all kinds were made and various cephalic indices calculated. When the question as to the relation of such to the ability of the individuals measured was raised, it led to attempts to get quantitative statements of ability. In this way considerable stimulus was given to devising and giving psychological tests. Binet himself at first thought that a short cut to the evaluation of an individual's mental ability might be obtained by some appropriate cephalic index. We shall see later on that he abandoned this idea.

In addition to the anthropological interest in the measurement of the head, we must consider the study of the head made by the much-discredited science of phrenology. It started from a perfectly legitimate and disinterested study of the localization of the functions of the cerebrum, continued with extravagant theorizings unsupported by experimental evidence, and ultimately fell into the hands of quacks and charlatans. The existence of this pseudo-science and the belief in it at the present time is surprising. We mention this merely as

an indication of the perennial human interest in the abilities and capacities of the human race and the all-absorbing desire of knowing something more definite about them. This interest is common to the psychologist who is constructing elaborate mental tests for prognostic purposes, as it is to the country bumpkin who pays a quarter to have his head examined to see what he is fit for and destined to become.

Conclusion. — We have attempted in this chapter to follow the two lines shown on the left half of our diagram on page 4, indicating the practical and theoretical forces that were at work leading to interest in and experimentation with mental tests, and culminating in the work of Binet in the first decade of the twentieth century. We have called the first the sociological trend because it deals with the attitude of society towards those of abnormal mental characteristics. In this sketch we have largely concentrated upon the feebleminded, because it was the feebleminded who first presented the problem of mental measurement as a definite task to the psychologist. The second, the theoretical or psychological approach, has shown us how the interest of psychology in the behavior of man naturally led to a study of individual differences and to an attempt to measure these differences, culminating with the mental test as we know it today.

And back of all this is the perennial interest of mankind in its own capacities, an interest that shows itself in phrenology and fortune-telling, in palmistry and graphology as well as in the laboratory or the clinic of the psychologist.

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CHAPTER II

THE WORK OF BINET

The work of Binet is important and merits special consideration because of the great stimulus he gave intelligence testing by the construction of the famous Binet-Simon Scale for the measurement of intelligence. It is of great importance historically because so much of the later development of intelligence testing is implicit in his work. We are still elaborating upon the ideas that he set forth, and his concept of intelligence is essentially the one that is held at the present time by psychologists. This does not mean that measurement of intelligence would not have been attempted without the work of Binet. It certainly would, and we have tried to show in the previous chapter the forces that were acting in that direction. The work in mental tests started by Cattell, and particularly the work of Thorndike in educational measurement, would undoubtedly have culminated in the testing of intelligence as we know it today. In England the work of Burt was also distinctly tending in the same direction. But it seems unquestionable to the writer, that without Binet this development would have been much slower and would probably not have taken the decidedly practical turn at the outset which the work of Binet gave it.

Biography. — Alfred Binet was born in Nice, France, on July 11th, 1857. His father was a physician and his

mother an artist. He was a pupil at the Lycée Saint Louis, Paris. He later received his *licencié en droit* in 1878. He then studied medicine, and worked particularly under Charcot and Féré. To the influence of the former he undoubtedly owed his knowledge of and interest in abnormal psychology. During this period he published a memoir, "*Sur la vie psychique des micro-organismes,*" and also "The Psychology of Reasoning." In conjunction with Féré he published "Animal Magnetism" and later on, in 1891, he wrote "Alterations of Personality." In 1889 Beaunis and Binet founded the Psychological Laboratory at the Sorbonne. In 1890 Binet received his *licencié ès sciences naturelles,* and in 1892 he became adjunct director along with Professor Beaunis of the Laboratory of Physiological Psychology at the Sorbonne. Later on, he himself became Director of the Laboratory and held this position until his death. In 1894 he received his *doctorat ès sciences* with a thesis entitled, "*Contribution à l'étude du système nerveux sous-intestinal des insectes.*" The next year, in 1895, he founded "*L'année psychologique*" which was to prove the main avenue for the publication of his future work. Indeed, many of the thick volumes of this periodical are largely made up of the writings of Binet himself. One is forced to marvel at his capacity for work. A perusal of the volumes of the Année is the best means of tracing the growth of his interest in intelligence testing, culminating in 1905 with the first set of tests, and followed thereafter by the elaboration of the Scale in 1908 and the revision of the Scale in 1911, the year of his death. In 1900 the "*Société libre pour l'étude psychologique de l'enfant*" was founded, an association of psychologists and school teachers who

worked on practical problems in the schools under the leadership of Binet. In 1904 the Minister of Public Instruction appointed Binet a member of a commission made up of medical men, educators and scientists to formulate recommendations for the administration of special classes in the public schools. As a member of this commission Binet did excellent work in spite of the opposition of many of the physicians. His work on the commission stimulated him to put his tests to practical use. Along with Simon he tried them out in the school and thus appeared the first rough scale in 1905.

Binet's death at the age of 54 on October 11th, 1911, leaves one with the feeling of a great loss to the science of psychology because of the conviction that he would have continued and developed the concepts inherent in his work. We have unquestionably lost the extension by him of these concepts to the field of psychiatry, a line of thought that he was following out at the time of his death.

Measurement. — It may repay us, therefore, to make a brief survey of some of his articles as they appeared in the Année, dwelling more particularly on those that are directly or indirectly connected with the idea of mental measurement. As early as 1896 we find him collaborating with Henri in an article discussing the field of individual psychology. In 1898 he contributes an article to the *Revue Philosophique* with the significant title, " Measurement in Individual Psychology." The question of measurement, he says, is the important thing — " How can we measure richness of inspiration, accuracy of judgment and the general ability of the mind? " Present-day psychology is gradually answering this question that Binet propounded more than

twenty years ago. It is interesting, moreover, to note the tests that he mentions in this same article. Some of these are: — drawing a square from memory; suggestibility to length of lines; memory for numbers, rearrangement of dissected sentences; answers to questions involving moral judgments; comprehension of an abstract passage; folding paper test. We see here the beginnings of the tests that later on proved so useful in his scale. It is not measurement in the physical sense, says Binet, but classification of individuals with reference to others. This again is one of the fundamental concepts of mental measurement. Indeed this article of Binet embodies surprisingly the gist of present day thought on mental measurement, and looking back from our present position it would seem as if nothing could have been more simple than for Binet to march straight on toward the scale of tests. As a matter of fact, however, there were many difficulties to be overcome and the way that he actually took was long and devious. Before he adopted the simple tests foreshadowed here, he tried many other possible means of measurement.

The next year he published an elaborate study on the consumption of food in relation to mental work, and in the same year also we note an article on anthropometrical measurements of abnormal boys by Simon, a man who later became so closely identified with Binet. This was a comparison of measurements of the waist, thorax, head, etc., with those of normal boys. It may be interesting to notice that in this article Simon refers to his doctor's thesis entitled, " Documents pertaining to the correlation between physical and mental development " (1900), showing that Simon

early became interested in the problem of mental development.

Attention and Adaptation. — In this same volume also we have Binet's long contribution on "*Attention et Adaptation,*" his most important work prior to the scale proper. His attempt here, he says, is to measure voluntary attention or more particularly to study voluntary attention in relation to intelligence and as a means for distinguishing differences in intelligence. For Binet, to measure is by this time synonymous with giving tests, and we, therefore, see him once again exercising his ingenuity in the devising of simple tests. This time among others, we note designs from memory, and the truncated pyramid and Greek key pattern, which now have become famous in the Binet Scale and its adaptations, appear here. He also uses dot counting, simultaneous adding, cancellation, reaction time and the like. These tests he gives to two groups of children of known intelligence. One group is bright and the other dull, or intelligent and unintelligent, as he calls them. The intelligent, he says, show a quicker and a better adaptation. "We have implicitly admitted that attention consists in a mental adaptation to a situation which is new to us." How surprisingly close to Stern's well known later definition of general intelligence does this thought of Binet come.

Head Measurements. — The next year we see Binet going off on one of his numerous tangents into a lengthy piece of work on the technique of the measurement of the living head. Our chief interest in this work lies in the fact that he compares the head measurements of intelligent and unintelligent pupils. The differences between the averages of such groups are always in favor

of the intelligent group, but then the differences are small and the overlapping great. The more carefully the groups are selected the greater the differences become. The intelligent child is distinctly superior. Nevertheless for individual diagnosis such measurements are useless.

In spite of this negative result so far as our main interest is concerned, the next year of Binet's publications shows nothing but a number of articles all dealing with the results of his cephalometric research. He plunges into the question of the growth of the head in children between the ages of four to eighteen. He compares the head measurements of the blind and the deaf with those of normal seeing and hearing individuals.

Seeming to have exhausted his interest in this direction, we see him in the following year comparing intelligent and unintelligent groups of children with reference to their sensibility as measured by the two-point threshold on the skin. The intelligent have a larger percentage of correct responses. He believes these experiments with the aesthesiometer are a good measure of voluntary attention.

Higher Mental Processes. — In 1903 appeared his book "*L'étude expérimentale de l'intelligence.*" Here he takes intelligence in a broad sense as equivalent to the higher mental processes. He does not theorize much but details all his attempts at measurement with innumerable tests. In the main he uses as his two observers his two daughters, thirteen and fourteen years old. Among the tests used we find the completion of sentences, the description of an object and the description of a picture. The picture used is that of a peddler and his boy pulling a wagon, the same picture used later

in his scale and revived in the Yerkes-Bridges Scale.

Handwriting. — In 1904 appear a few minor articles showing the wide range of his interests. One deals with a psychological analysis of the writings and mental make-up of a French writer, Paul Hervieu. The other is a study of graphology and raises the question as to whether handwriting experts can determine sex, age and intelligence. Note again how almost all his work brings in the question of intelligence in some form or other. He is rather favorably disposed towards the position that handwriting is a crude index of intelligence.

Feeblemindedness. — Our brief survey up to this point of the articles published by Binet has made it sufficiently clear that the measurement of intelligence had been one of his main thoughts at least for the past ten years. Almost every piece of research is directed toward the discovery of methods of differentiating between degrees of intelligence, and, as we have seen, his attempts have ranged all the way from mental tests proper to a study of handwriting. The contributions to the *Année Psychologique* for 1905 are very largely the work of Binet alone, or of Binet and Simon in collaboration. First of all we have a short article on the question of mental fatigue; then an article criticizing Van Biervliet's proposal for the measurement of intelligence indirectly and simply by means of attention. There is also a practical article by Binet and Simon dealing with children who have been released from a school for the backward or feebleminded. They found in the institution investigated little knowledge of or interest in the children who had left. They urge the need of a psychological examination for all children in such institutions. This should be done yearly and incorpo-

rated in an annual report. They also deplore the lack of follow-up methods. This article is obviously an outgrowth of the work the two authors were doing in the feebleminded institutions.

There next appear in the volume three articles by Binet and Simon covering pages 163 to 336 inclusive. The first is theoretical and historical in tone. It brings out the unsatisfactory nature of our usual methods of diagnosing feeblemindedness, which are vague and subjective. It recounts all attempts up to that time at making the procedure more objective and the writers mention as praiseworthy the efforts of two French physicians, Blin and Damaye, in their attempt to draw up a list of questions with a method of scoring.

The First Scale. — The second article is entitled, "New Methods for the Diagnosis of the Intellectual Level of Abnormal Children." Here appears for the first time the idea of a scale of intelligence, "*une échelle métrique d'intelligence.*" Here too we find the first specifications of intelligence tests, namely, they must be simple, must not consume a long time, they must be heterogeneous and not pedagogical. The thirty tests proposed are arranged in a series of increasing difficulty. They include many of the tests that we have noted in the previous work of Binet. The tests are not grouped according to age. They are merely to be scored with whole or half credit or no credit. So far the authors have not arrived at the idea of mental age. We have, however, in this article the original tests, the idea of a graded series, the concept of intelligence and a conception of the fundamental qualities of an intelligence test. This set of tests is sometimes called the 1905 Scale.

In the third article, following immediately the one described above, we find the authors applying the tests they have just described to groups of normal and abnormal children. The article is very lengthy and minute details of application and the results obtained from children are given. It marks no further advance in test procedure. It merely gives us a picture of the authors at work in applying the tests to children. And the main thing that Binet and Simon seem to have gained from this experience is the necessity for laying more emphasis upon the methods of giving and scoring the tests. They are moving rapidly toward the concept of a standardization of procedure.

The 1908 Scale. — Little of importance for our topic was written by Binet during the next two years, although it is unquestionable that during this time he was trying out in actual practice the tests he had formulated in 1905. In 1908, therefore, appears his important article entitled "The Development of Intelligence in Children," in which he describes in detail the so-called 1908 Scale. This scale appears later in our book in Chapter V, and a detailed description is, therefore, unnecessary here. The important point to note is that the tests are now grouped according to their appropriate ages. Furthermore the idea of a mental age is now introduced. This is one of Binet's important and valuable contributions to the problem of mental testing. The mental ability of any individual is expressed by the age that he reaches in the graded series of tests and this age is known as his mental age. To find out which tests were suitable to each age, Binet tested presumably normal children at each age and if from 60 to 90 per cent of such children passed the test, the test was

considered standard for that age. Here, therefore, we see the beginnings of test standardization. The number of children tested and the method employed may seem unsatisfactory to us at the present time, but we must remember that this was pioneer work on the part of Binet and Simon.

Mental Age. — The use of mental age as a measure of intelligence is undoubtedly due to Binet, although the comparison of an individual in regard to knowledge or ability with a child of a specific age had often been made previous to the time of Binet. Woodrow (19) tells us that Esquirol in 1828, Duncan and Millard in 1866, and Down in 1887 had all made comparisons between feebleminded and normal children on the age basis without, however, employing any tests. Hall (48) in his description of the trial of one William Freeman, colored, charged with having killed four persons unknown to him and without provocation, reports that a Dr. Dimon, psychiatrist, said that the accused " in point of knowledge was equal to a child of two or three years." Undoubtedly many other references could be gathered of the use of mental age in this vague and haphazard manner. It remained for Binet to take this relatively useless concept and crystallize it, to make it definite and concrete, and to raise it into one of the most practical and useful concepts for the psychologist and psychiatrist.

Miscellaneous Studies. — During this same year, 1908, Binet published several articles and they show his versatility and the wide range of his interests. One of these is a study of the results of a questionnaire among teachers of philosophy in French colleges and universities. He finds from this study that there is a growing

dislike among students for formal logic and an increasing interest in science and sociology. Another article discusses the relation between language and thought. He compares an imbecile who has little speech with a real aphasic and questions Marie's dictum that every aphasic shows a diminution in his general intelligence. Language, he concludes, is not co-extensive with thought. He is inclined to hold to the theory of imageless thought. Still another article deals with palmistry in which the professional palmist is allowed to see only the hands of the subject and then to estimate the intelligence. Similar judgments are made from pictures of hands. The results are only a little better than pure chance. In a footnote to this article Binet excuses himself for dealing with palmistry by saying that he has investigated everything for a measure of intelligence, the head, the physiognomy, physical stigmata and now the hand. Thus we see Binet still casting around for measures of intelligence, while at the same time pushing forward with the scale of tests that was to achieve such signal success.

In 1909 we have a long and excellent article by Binet and Simon on the psychology of the feebleminded, covering a great many traits, such as attention, voluntary effort, movements in writing, the sense of pain, the number sense, and the like. There is much detail and several excellent descriptions and, as usual, the writers give the results of numerous tests to illustrate their points.

Insanity. — In the same year we see Binet applying his scale to particular types of insanity. He investigates the intelligence of general paralytics and senile dements. The difference, he says, between the general paralytic and the imbecile is the difference between a disturbance in

the *functioning* of the intelligence on the one hand and in the arrest of the *development* of the intelligence on the other. The scale is useful for it seems to show that previous knowledge existed in the general paralytics and the senile dements. Two other articles published this same year show again his diverse interests. One is an article on the psychology of painting and the other a psychological study of a particular painter's work.

In 1910 Binet summarizes all his attempts to diagnose intelligence from external physical signs in an article entitled, "The Physical Signs of Intelligence in Children." He recapitulates his work on the dimensions of the head, the so-called stigmata, the face and the hands, and sums up by saying that, although the averages of groups may in certain measurements show appreciable difference, we, nevertheless, cannot judge the *individual* child by these external signs. The same year we have, in collaboration with Simon, a long article attempting to define and describe the principal mental states of the various forms of insanity. This shows Binet's interest spreading over from feeblemindedness to insanity.

The 1911 Scale. — Binet's last important article on mental tests appeared in the Année for 1911, the year in which he died, and contained a further revision of his scale, the so-called 1911 Scale. This scale is given in Chapter V of this book. It differs from the 1908 Scale in arrangement of tests and in the allotment of tests to each age. Some new tests are introduced and some of the old are dropped because they are too much like school work. Here we see the effect of a more exact differentiation between general intelligence and knowledge. He also raises the question of the relation

of intelligence to school standing and replies to what seemed a criticism of the tests on the part of Decroly and Degand who had used his tests in Belgium. These workers had found that on the average the children tested were one and a half years advanced, and Binet replies that it is perfectly feasible to suppose that such a difference really exists between the children of superior social standing tested by Decroly and Degand and the poor children of Paris on which his norms are based.

Tests for Soldiers. — There only remains to be mentioned a short article by Binet, written very probably shortly before his death, which is of interest in view of the unexpected development in mental testing in this country brought about by the European War. Binet summarizes in the Année an article written by himself and Simon in the *Annales Médico-psychologiques* for January 1910 on the need for a method of diagnosis to be applied to mentally defective soldiers. Binet and Simon seem to have taken up the matter with the military authorities and urged the adoption of psychological tests. They pointed out the desirability of eliminating the feebleminded recruits. No progress was made because the medical officers thought the tests unsuitable. Seven years later the Binet-Simon tests, revised for American purposes, were used with splendid results along with other tests in helping this country build up a large and efficient army. We can well afford to give Binet credit for being the first to make such a suggestion, without detracting from the distinction merited by the American psychologists who began the work in the army and carried it to a successful conclusion, and were not aware that this had been proposed by Binet.

Conclusion. — This brief survey of the writings of Binet shows extremely well how his attention and interest were from the start focussed upon the possibility of the measurement of intelligence. We have tried to show how he set this as his aim and how he worked incessantly at the problem, attacking it from every conceivable angle. The method finally adopted seems to us at the present time the obvious and natural method, but this was by no means the case at the time that Binet first started his work. His attempts to obtain an index of intelligence indirectly by means of head measurements or the two-point threshold on the skin reflects the dominant line of thought in psychology at that time. It was natural that Binet should seize the tools that were ready to his hand and attempt to use them for his purposes. At the same time we notice that the intelligence test method is used by him from the start. It is crude at first but is gradually refined. And so we see him swinging over from the one method to the other, now trying the indirect approach through head measurements or aesthesiometry or graphology or palmistry, and now devising and developing a larger number of intelligence tests as we know them today. Finally the intelligence test method wins and we see the Scale gradually emerging until it stands before us as a new method for the measurement of intelligence.

It is well to remember the gradual evolution of the Scale in the hands of Binet. The method is so simple that we are apt to forget that its growth was slow. The fact that the growth of the scale was so slow and that every test was so well tried out, may be the reason why the Scale has fulfilled so well its initial promise. The original Binet-Simon Scale will probably soon disap-

pear. It is in fact even now fast disappearing in the face of better revisions and new scales, but, nevertheless, all these are based upon the fundamental work accomplished by Binet. If, in the history of psychology, we call Wundt the father of experimental psychology, we must then call Binet the father of intelligence testing.

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CHAPTER III

THE DEVELOPMENT OF INTELLIGENCE TESTING AFTER BINET

In this chapter we shall attempt to indicate the general development of intelligence testing following upon the work of Binet. We have noted in a previous chapter the many influences that were at work leading to the development of intelligence tests even before Binet, and these influences would naturally have borne fruit regardless of the great French psychologist. It was, however, Binet's work that gave a very definite turn to the course of this development, mainly in the direction of attempts to measure general all-round ability rather than specific abilities.

We shall make no attempt here to trace further the social aspect of our problem, as we did in the first chapter, where we attempted to give the general historical background for the rise of mental testing. We shall only mention such social institutions as were directly affected by the vigorous growth of intelligence testing in that branch of it which came to be known as clinical psychology. It is enough to remind the reader here that institutions for the feebleminded and defective delinquents, which we have previously noted as springing up here and there in the nineteenth century, have continued to increase in numbers and efficiency in the twentieth. Child-caring agencies of all kinds have

greatly multiplied and special provision for backward or feebleminded children in the public schools is now taken as a matter-of-course in educational circles today. It would obviously take us too far afield to follow the development of these social agencies, all of which are making use of the intelligence tests devised by the psychologist, and in turn presenting problems to him for solution, which have thereby enlarged the field of his research.

Without attempting to follow any strict chronological sequence, we may, nevertheless, distinguish certain definite phases in the recent history of intelligence testing. These phases overlap each other greatly in point of time, and it is useless to attempt any sharp line of demarcation. We may classify them as follows: — 1. The Measurement Movement in Educational Subjects; 2. The Introduction of the Binet Scale into America; 3. The Controversy over the Validity of the Scale; 4. Clinical Psychology; 5. The Stanford Revision; 6. The Appearance of Other Scales; 7. The Group Test.

1. *The Measurement Movement in Educational Subjects.* — Simultaneous with the work of Binet in intelligence testing in France, there was arising in this country an interest in the objective measurement of school accomplishment. Rice's (97) report on spelling marked the beginning of the movement. But the real leader in the movement was Thorndike. Beginning in 1903 with his *Educational Psychology,* we note the emphasis he lays upon measurement. In 1904 his *Introduction to the Theory of Mental and Social Measurements* appeared, a book which had a profound influence upon the measurement movement. Stone's *Arithmetic Tests,* worked out under Thorndike's direction, were

published in 1908, and in 1910 the Thorndike *Handwriting Scale* appeared. From that time to the present, each year has seen the publication of one or more scales or tests for the measurement of educational subject-matter. Many of them have appeared under Thorndike's direction and all of them have been stimulated by his pioneer work. In addition to this Thorndike had done some work with mental tests, so that the introduction of the Binet Scale into America fell in line with the ideals and efforts of the measurement movement.

2. *The Introduction of the Binet Scale into America.* — Goddard was the first to introduce the Scale and to make use of it in this country. The psychological laboratory at the Training School for Feebleminded Children at Vineland was founded in 1906, and Goddard was made Director of the laboratory. It is noteworthy as being one of the first laboratories in an institution for the feebleminded devoted primarily to psychological work. Goddard had seen something of Binet's work in France and was acquainted with his scale as it applied to feebleminded children. In 1908 he began to use the Scale at Vineland and was speedily convinced of its usefulness. He set to work adapting the Scale to American conditions, making as few changes as possible. Preliminary work with the Scale made him doubt whether all the tests were rightly placed for American children and he, therefore, took the next logical step in his standardization of the Scale on 2000 American children. This standardization was published in 1910, and is based upon Binet's 1908 Scale. Goddard followed essentially Binet's method of standardization, although he made use of a much larger number of cases than Binet had used at any one time in the making of his

scale. This revision of Goddard's remained for a long time the standard for American practice. The Training School for Feebleminded Children at Vineland, where Goddard was director of the psychological laboratory, became the Mecca of all those interested in the new clinical psychology, and the storm center around which much of the heated discussion as to the validity of the Binet-Simon Scale raged. The work at Vineland was ably supported by other men, notably by Kuhlmann and Huey, both psychologists attached to institutions for the feebleminded. Without going into detail we may say that the emphasis at first was laid upon the use of the Scale for the detection of feebleminded children. Vineland led the way in using the Scale as a means of classifying all the children in the institution, and very soon came to use it as a routine procedure for the admission of all new cases. From Vineland the use of the Scale spread rapidly to other institutions. The point to note, however, in the early use of the Scale is that for practical purposes its use was almost entirely restricted to the feebleminded. Normal children were tested in the main solely for purposes of standardization. Some share of the prejudice against mental tests among the public at large must be attributed to this fact. To allow a child to be "submitted" to a mental test was, and still is, to some extent, equivalent to raising the question as to the integrity of his intelligence, because mental tests were from the beginning so closely associated with the feebleminded. This attitude towards mental tests is now rapidly disappearing, but it was a prejudice against which psychologists had to fight in their efforts to widen the scope of mental testing.

3. *The Controversy over the Validity of the Scale.*

— From the very beginning the validity of the Binet Scale and the possibility of the measurement of general intelligence was challenged. Leaving aside criticism by non-psychologists, we find at the outset some psychologists who are opposed to the method as being unscientific and founded upon false premises. There were many who refused to recognize the work of the " mental testers " and regarded the whole matter as a fad that would soon fade into oblivion. As time went on, however, this attitude gradually disappeared, and no one at the present time would be bold enough to assert that mental measurement is a passing fad.

More serious and, sometimes, constructive criticism centered upon the actual tests themselves, the method of procedure and the problems of standardization. This criticism came from men who were more or less directly working in the field. It centered naturally around the Binet Scale. At the one extreme we find those who, while admitting the soundness of Binet's general conception, would, nevertheless, so revise and alter the tests and procedure as to leave practically nothing of the original Scale. At the other extreme are to be found those who treat the Scale as if it were something sacred and as if it had emerged perfect from the hands of the master. Between the two extremes are the workers who by actual trial and error modified, revised and enlarged the work that Binet began.

It might be amusing, but it could hardly be profitable to enter into a detailed account of this period of criticism. Much of it has no application at the present time, and it has already faded into the historic past so rapidly as to make one smile at the emotional outbursts and personal feelings that were aroused.

Much good resulted from these controversies nevertheless. The necessity for standardization of procedure, so that examiners could compare their results, was emphasized. A clearer line of demarcation was drawn between tests of intelligence and tests of knowledge. The need for other kinds of tests became obvious in cases where the Binet tests could not apply, especially in cases of language difficulty. The problems of standardization were discussed and the desirability of more careful placing of tests emphasized. All this discussion helped to a better understanding of just what "general intelligence" signified, and led us slowly to recognize certain conditions that a test ought to fulfill in order to be considered a good test of general ability. On the whole, therefore, the controversy that raged around the Binet Scale left us with clearer ideas as to the problems and methods of intelligence testing, even although much of it was mere opinion and useless.

4. *Clinical Psychology.* — Although clinical psychology proper dates back at least to the last decade of the nineteenth century, it is undoubtedly true that the Binet Scale was the one most potent factor in its development and expansion. Shortly after the first work with the Scale in the institutions for the feebleminded, we find psychological testing of all kinds spreading rapidly to juvenile courts, reformatories, prisons, children's homes and schools. The psychological clinic did not and does not depend upon the Binet Scale, but it is unquestionably true that the appearance of the Binet Scale acted as a tremendous stimulus to this type of work.

Notable among the juvenile court clinics was the one at Chicago under Healy and Bronner. Here no undue

emphasis was given to the Binet Scale, but the value of the Scale and of other mental tests was well recognized in relation to the larger field of work covered by the clinic. Many other juvenile courts have found the services of clinical psychology of value and a few maintain special clinics, while others depend upon the help of outside psychologists.

Among clinics established in reformatories and other penal institutions, one of the most noteworthy was the psychological clinic at the New York State Reformatory for Women at Bedford Hills. Real constructive work in the way of enlarging the field of intelligence testing has been done here under the direction of psychologists. Many other reformatories have had or still have clinics, where the scope of the work ranges from a very exhaustive examination down to the giving of a short set of tests. Many reformatories, prisons and penitentiaries have been surveyed by psychologists and their results have been of value in increasing our knowledge of the mentality of the criminal.

And, lastly, many school systems have recognized the importance of psychological work. School clinics have been established in connection with the education of backward and feebleminded children. As we have seen in Chapter I, especial attention to the backward child began in the nineteenth century. At first the interest was entirely pedagogical, but it was not long before the help that psychology could render was appreciated and we see the coming of the school psychologist, whose duty it is to select the backward children for the special class. The number of these clinics, or departments of child study, is now great, and the work they are doing varies from minute and thorough psychological

testing down to the mere giving of Binet tests to aid in the segregation of the mentally retarded. There is a place in every school system for psychological tests and unquestionably the future will see a great expansion of their use in our schools. At the present time the center of interest in psychological work in the schools is shifting from the mere segregation of the mentally retarded to a wider use of intelligence tests in the classification of pupils in general and much attention is being paid to the child of superior intelligence. We are beginning to realize that the bright child as well as the dull needs special educational guidance.

The rapid expansion of the use of intelligence tests in our schools has assisted and been assisted by the development of educational tests and measurements. The rise of such measurements forms an interesting chapter in school history but it lies outside the scope of this work. Undoubtedly the two kinds of measurement, the one probing the native ability, the other the knowledge of the child, are complementary, and the future will see a more intimate use of the two combined.

5. *The Stanford Revision.* — The publication by Terman of the Stanford Revision of the Binet-Simon Scale in 1916 marks a distinct advance in intelligence measurement. Even before the publication of the Binet-Simon tests, Terman had been interested in the problem of individual differences in intelligence among school children, and shortly after the first publication of the Binet tests by Goddard in 1908, he seems to have become interested in Binet's method. During 1910–11 Terman and Childs constructed a tentative revision and extension of the Binet 1908 Scale, which they published in 1912. Terman considered this merely

a tentative revision, because his experience with the Scale so far had shown him the great possibilities in the way of further extension and more complete standardization. This revision, extension, and standardization occupied Terman and his co-workers for the next five years and the final result certainly justified the labor and time involved.

The Stanford Revision adds nothing essentially new to the ideas of Binet. What Terman did, however, was to work out more thoroughly and more accurately the method suggested by Binet. The scope of the standardization was broadened and the scale was so adjusted as to fit accurately at each age. Much of what is only implicit in Binet is made explicit by Terman. One other important contribution by Terman is worth noting, namely, the adoption of the Intelligence Quotient as suggested by Stern. The use of the I. Q. by Terman in connection with his Scale brought this measure of intelligence into common use.

6. *The Appearance of Other Scales.* — It was natural that the stimulus given to mental testing by the use of the Binet-Simon Scale should result in the construction of other scales for measuring intelligence. If there are few, it is not because of a scarcity of ideas as to different tests, but rather because of the labor involved in standardization. We shall mention here the more or less well standardized scales, which are not obvious revisions of the Binet, but which have been stimulated by it. The Point Scale by Yerkes, Bridges and Hardwick (15) used the original Binet Tests but substituted a scoring method for each test and a total score instead of the "all or none" method and the age grouping of tests in the Binet.

The Pintner-Paterson Performance Scale (17) was the first scale to use tests entirely different from those of Binet. None of the tests in the scale require a knowledge of language by the subject. In this respect also it is very different from the Binet, where directions are given orally and most of the responses are oral. The scale has been found useful in the testing of foreign children, deaf children and also as a supplement to the Binet Scale. The Army Performance Scale (Memoirs 21) was constructed to supply the army examiners with a means for measuring the mentality of the foreigners in the army when an individual examination, in addition to a group test, was required. Several of the tests used in the Pintner-Paterson Performance Scale are included in this scale, in addition to many others. The scale has not been standardized on children, but the scores can be turned into an approximate mental age based upon a comparison of Performance Scale and Stanford and Point Scale records gathered in the army.

The Herring Scale (22) follows the Binet in type of test, but all the tests used are different. It also differs in method of scoring and of computing mental age. It is intended to cover the same ground as the Stanford Revision and it correlates highly with the latter.

7. *The Group Test.* — The most recent development in mental testing has been the rise of the group test. Here the subjects are examined in groups in contradistinction to the tests we have just described, in which the examiner is engaged with only one individual at a time. There is, of course, nothing intrinsically new in the group method, because it has been employed for a long time in psychological experiments. For the most part, how-

ever, these experiments were not directly concerned with getting an intelligence rating of the individual, and the new turn given to group tests at the present time is precisely the attempt to obtain a measure of the individual's mental ability.

For a long time there existed a distinct prejudice on the part of psychologists against the group test. Although the method had never been adequately tried out all sorts of *a priori* reasons as to why it could never be feasible were advanced, and most of these reasons have disappeared into thin air now that the method has been tried and developed. The group method does not give us all the information gleaned by the expert clinician in his individual examination, but it can give a very reliable intelligence rating.

We see the beginnings of the group method in the work of Thorndike and others with the early mental tests. After the introduction of the Binet tests, it was natural that the quicker group method should be tried out in order to arrive at a mental rating of more than one child at a time. Thus Pyle (13) gave several tests to groups of children, but did not combine the results of all the tests into one index to denote a child's intelligence. This was done by Pintner. Influenced by the work of Pyle and confronted with the practical problem of having to weed out the feebleminded children from among a large group of children, Pintner (17) used a set of six tests as group tests and took the median of the six percentiles as a measure of the child's mentality.

At the same time group tests were being used by Scott in his work of measuring the ability of business executives and salesmen. From these and other beginnings it is obvious that group testing was in the air

and that it would have developed slowly toward the goal that it has now attained. The entry of this country into the European War and the consequent utilization of intelligence tests in the army accelerated enormously the development of the group test. The different tests at present available will be discussed fully in Chapter VI.

Summary. — Considering the broad outlines of the development of intelligence testing since the work of Binet, we may discern three phases. The first is the introduction of the Binet Scale into this country, leading to minute work and much discussion of the principles involved, stimulating the development of clinical psychology and of intelligence testing in schools and institutions of all kinds and culminating with the Stanford and Herring Revisions, as representing the latest and most modern development of Binet's original idea.

Secondly, we see the construction of other kinds of Scales, diverging more or less from the principles of the Binet Scale, broadening our conception of the intelligence scale and extending the field of intelligence testing to different types of subjects.

And, thirdly, we note the rapid rise of the group test, introducing the concept of intelligence surveys of large numbers of individuals, breaking away from the method of the Binet Scale and opening up unlimited possibilities for the psychologist in the future.

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CHAPTER IV

THE CONCEPT OF GENERAL INTELLIGENCE

Gradual Growth of the Concept. — In the preceding chapters we have been speaking of the measurement of general intelligence, without having attempted in any way to define the meaning of this term, and it is not easy even at the present to do so. As a matter of fact general intelligence has rightly been assumed to exist and psychologists have gone about the measurement of an individual's general ability without waiting for an adequate psychological definition. This must not be taken to imply, however, that the psychologist was blindly measuring something, without having any conception of what he was trying to measure. In every case the psychologist has some rough working hypothesis upon the basis of which he proceeds, and it is these hypotheses and the logical conclusions that follow from them that we shall now briefly survey.

As we have noted in our historical account, the earlier attempts at mental measurement were concerned with the measurement of separate faculties, processes or abilities. Tests were devised to test different kinds of memory, attention, imagination and the like. Binet's efforts were at first largely devoted to the measurement of the higher and more complex processes such as reasoning, imagination and so on. Again, Binet very frequently compared

intelligent and unintelligent children in their methods of reacting to certain tests. Note carefully that his intelligent and unintelligent children were not so called on the basis of psychological tests, but simply on the basis of the ordinary subjective judgment of the teacher or parent, i.e., the ordinary common-sense judgment of the world. It is easy to imagine, therefore, that Binet became almost unconsciously familiar with intelligence as a complex trait of an individual's make-up and very probably began to use unconsciously the type of reaction he had found common in his subjects as a criterion by which he might judge intelligence or lack of intelligence in unknown subjects. Be that as it may, the transition from his early work on groups of intelligent and unintelligent subjects, as diagnosed by the world, soon led him consciously to reverse the process and to diagnose the intelligence of his subjects by means of tests.

It is well to insist upon the fact that the meaning of general intelligence has been a gradual growth and that we did not start with a clear definition of general intelligence set up by some psychologists and forthwith proceed to measure it by means of tests. We may say rather that the psychologist borrowed from every-day life a vague term implying all-round ability and knowledge, and in the process of trying to measure this trait he has been and still is attempting to define it more sharply and endow it with a stricter scientific connotation.

As we go through the writings of Binet we do not find any well-formulated and standard definition of general intelligence, but rather numerous descriptions of it, now emphasizing one of its aspects and now another. For a long time, indeed, he did not seem to differentiate it clearly from knowledge, just as it is not at present clearly

differentiated from knowledge in popular thought. Later on, this differentiation from knowledge creeps in, but only after he has had considerable experience with measuring intelligence by means of his scale of tests. Practical work with the scale made this differentiation necessary. This is a good example of the manner in which the meaning of the term " general intelligence " is acquiring a definite psychological connotation.

Binet considered attention and adaptation as the two most important factors in general intelligence, although we must not forget that he employs the term attention in a much wider sense than is ordinarily the case in psychology. One of his longest articles is devoted to a study of attention and adaptation in order to see how intelligent and unintelligent children differ in these two respects, and many of the tests he devised to bring out these differences were later found useful in his scale. Judgment, again, is a term Binet (16) is fond of using and of emphasizing in his concept of intelligence. Intelligence, he says, " is judgment, or common sense, initiative, the ability to adapt oneself." And again, " To judge well, understand well, reason well — these are the essentials of intelligence." " Binet's definition emphasized three phases of behavior: (1) the ability to take and maintain a given mental set; (2) the capacity to make adaptations for the purpose of attaining a desired end; and (3) the power of auto-criticism." (Hollingworth, 20.) Descriptions of this kind are Binet's contribution to a definition of general intelligence.

Definition. — It remained for the German psychologist Stern (14) to give us one of the shortest definitions of general intelligence, and the one that is most commonly accepted at the present time. " Intelligence is a general

capacity of an individual consciously to adjust his thinking to new requirements." And again, and perhaps better, " It is general mental adaptability to new problems and conditions of life." By this definition Stern differentiates general intelligence from talent which is the development of a specific ability, and again from knowledge or mere information, and lastly from memory because this deals with the old, whereas general intelligence is directed toward the new. Further he says, " Any sort of perceptive, memorial or attentive activity is at the same time an intelligent activity just in so far as it includes a new adjustment to new demands." These statements of Stern are often further contracted as follows: *" General intelligence is the ability of the organism to adjust itself adequately to new situations,"* and this is our best definition at the present time. Obviously we could debate at length as to what is meant by " adequately " or " adjust " or " new," but such debate would lead us too far afield and serve no practical purpose.

The definition given conceives of general intelligence as including behavior that leads to better and better adaptation not only in man, but in the whole animal kingdom. It includes the capacity for getting along well in all sorts of situations. This implies ease and rapidity in making adjustments and, hence, ease in breaking old habits and in forming new ones. Fundamentally, this leads us back to the general modifiability of the nervous system. An organism whose nervous system is very modifiable, can adjust itself to new types of situations and react adequately to a great number of different situations. The intelligent organism has a multiplicity of responses; the unintelligent few. The

intelligent organism responds to a great number of situations; the unintelligent to few. Intelligent behavior leads one from one thing to another in ever-widening circles; unintelligent behavior is narrow and restricted, and leads to repetition or cessation.

Other Definitions. — Many other definitions of intelligence have been suggested. A number of these have been published in a Symposium on Intelligence (21) in the Journal of Educational Psychology. Most of the writers prefer not to give a short definition but to describe what they mean by intelligence at greater length. Among the shorter definitions we find a few as follows:

" We may then define intellect in general as the power of good responses from the point of view of truth or fact." — Thorndike.

" An individual is intelligent in proportion as he is able to carry on abstract thinking." — Terman.

" An individual possesses intelligence in so far as he has learned, or can learn, to adjust himself to his environment." — Colvin.

" Intelligence is intellect plus knowledge." — Henmon.

" Intelligence seems to be a biological mechanism by which the effects of a complexity of stimuli are brought together and given a somewhat unified effect in behavior." — Peterson.

" Intelligence is an acquiring capacity." — Woodrow.

Obviously these definitions overlap to some extent and contradict each other also to some extent.

Woodworth (21) describes what the subject in a test must do; — " He has to see the point of the problem now set him, and to adapt what he has learned to this novel situation." These two elements, " seeing the point " and " adapting oneself to a novel situation,"

he includes under the general factor of responsiveness to relationships. And to this general factor he would add a second, namely, retentiveness.

Ballard (22) would define intelligence as "the relative general efficiency of minds measured under similar conditions of knowledge, interest and habituation."

Wells (17) says, "Intelligence means precisely the property of so recombining our behavior-patterns as to act better in novel situations."

These samples of definitions of intelligence must suffice. There are a great many more. We need only add a useful way of thinking of intelligence, particularly for the teacher, namely, as *ability to learn.* For the intelligence test is a good index of a child's ability to learn in school, if he is interested and willing.

Theories of General Intelligence. — So far we have been dealing with definitions or descriptions of general intelligence, which make no attempt to explain in a more thorough-going manner the nature of general intelligence or its relation to the different abilities or traits of the individual. There are, however, one or two theories of intelligence that attempt to go further than the mere descriptions. Of these Spearman's (04) theory of the nature of general intelligence is the most interesting and one that has been formulated in greatest detail. Indeed, it is the only theory that has been comprehensively worked out, and, therefore, merits some attention, even although it has not found many adherents.

According to Spearman, all performances depend, to a certain degree, upon one and the same general common factor; i.e., General Ability or General Intelligence. A person's success in any intellectual perform-

ance is the joint product of two factors, namely, the specific ability for the task in question and the general ability of the person. It is from this manner of stating the theory that it is sometimes known as " the theory of two factors." The first factor is the general factor, as when Spearman (14) says, " All intellective activity depends in some degree on one and the same general fund of mental energy." The second factor is an individual's " specific capacity for that particular kind of performance." The general common factor contributes something to each specific performance, or, in terms of cortical activity, we may say that " each momentary focus of cortical activity receives continual support from energy liberated by the entire cortex." Physiologically this general factor would seem to be synonymous with the plasticity of the nervous system and Spearman speaks of it as a " plastic " function. It is very probably a quality of the nerve tissue.

For a proof of this theory Spearman depends very largely upon mathematical correlations, and Spearman by this work has contributed largely to our knowledge of the application of correlation to psychology. It would take us too far afield, however, to enter into the discussion that has arisen over Spearman's attempt to prove his theory by means of his so-called hierarchy of coefficients. Other workers, using Spearman's own formulae, do not find this hierarchy and they have, therefore, challenged his theory.

It does not follow, of course, that Spearman's theory falls, even if his method of proof is not valid. Hart and Spearman (14–15) have attempted to gather additional evidence in support of the theory from the field of abnormal psychology. If the general factor depends

upon the integrity of the entire cortex, then it should follow that if there is a lesion anywhere in the cortex there should be a general lowering in ability, and that those performances which are most dependent upon " general ability " should be most affected. And such a general lowering of the individual's ability is what Spearman and Hart claim to have found in their tests on several different types of insane people.

Burt (09–10) would seem to follow Spearman to some extent, but he gives a certain turn to the discussion which brings us back remarkably near to Binet's conception. He says, " High intelligence seems to mean high capacity for continually systematizing mental behavior by forming new psycho-physical co-ordinations, older co-ordinations being retained, so that newer co-ordinations bring with them increased complexity and incessant change." And again, " In such progressively integrative actions of the mind the efficient and directive agent is attentive consciousness. Voluntary attention is the essential factor of general intelligence." Burt therefore finds in voluntary attention, just as Binet did in " attention and adaptation," the common factor which is called general intelligence. It may be interesting to note here that in the work of Webb (15) the concept of Spearman of a common factor for intelligence has been carried over to the investigation of character and an attempt has been made to find a common factor in character.

Although Spearman's theory has not been generally accepted, it has stimulated a great deal of valuable discussion and has brought with it a fuller understanding of general intelligence. In opposition to Spearman we have the commonly accepted view of a great number

of specific abilities, not bound together by a common factor. Thorndike may be said to be the representative of this point of view. There is no necessity to postulate a new factor. What we have is a number of specific abilities and we find a high correlation between these abilities because of the elements that are common to many of them. Sometimes we do not find a high correlation, as Spearman maintains, and in that case we have few common elements. For example, between what Thorndike (09) calls the level of sensitivity and the level of association we do not find a high correlation. "The efficiency of a man's equipment for the specifically human task of managing ideas is only loosely correlated with the efficiency of the simpler sensori-motor apparatus which he possesses in common with other species"; and again (14) "the mind must be regarded not as a functional unit, nor even as a collection of a few general faculties which work irrespective of particular material, but rather as a multitude of functions each of which involves content as well as form, and so is related closely to only a few of its fellows, to the others with greater and greater degrees of remoteness."

This brief survey of theories of general intelligence will serve to show the disagreement existing at the present time. Both theories have much that is stimulating in them and will lead us to understand the problem of mental testing in its wider aspect. For practical purposes, however, it matters little whether we believe that a high correlation is due to a central factor or to many common elements. We may, therefore, pass on to the development of the concept of general intelligence as shown in the empirical requirements of an intelligence test as we know it today.

The Criteria of a Test of Intelligence. — Influenced both by the theoretical discussion of general intelligence and by the empirical work of testing, we have arrived at certain requirements for a good test of intelligence, which we may discuss under the four following headings:

1. *Tests must be relatively new.* — A good intelligence test must avoid as much as possible anything that is commonly learned by the subjects tested. In a broad sense this rests upon a differentiation between knowledge and intelligence. To use as a test of intelligence something that is commonly taught in school is not desirable, because those children who have reached the particular grade in which this is generally taught have memorized this fact, whereas other children of equal or greater intelligence may have had no opportunity to learn this same fact, simply because they may not have reached this particular grade in their school work. To ask the question, "Who discovered America?" would be indicative of the school progress or general cultural environment of the child rather than of his general intelligence. Failure to answer might indeed be due to lack of intelligence in the case of school children of a certain grade in which this had been a matter of instruction, but on the other hand a very intelligent child might fail to answer owing to the fact of his not being in the grade in which this was taught.

On the other hand such tests as choosing the prettier of two very contrasting faces (Binet Scale, V, 3) or comprehension of common-sense questions (Binet Scale IV, 5; VI, 4; etc.) do not depend upon specific school instruction at any given period of a child's life. They are things which any ordinary child has an opportunity of picking up from his general environment. Only in

very exceptional cases would such tests be unfair as tests of intelligence. In many cases the child may never have done just exactly the thing demanded in the test, but, granted a certain degree of intelligence, he will be able to perform the test the first time.

There is clearly, then, a broad distinction between specific things which have been taught and those which a child unconsciously acquires from his environment, and the former are to be ruled out as intelligence tests. There is, however, no sharp dividing line between these two groups and many things which belong to the one group for some children will belong to the other group for others. For example: to know one's age is a good test for young children up to four or five. Ability to pass this test is not, however, a positive indication of intelligence in adults, for the adult may be very feeble-minded and yet may have acquired this as a piece of knowledge. He may have been deliberately taught this fact. Again, to take a more drastic case, tests involving the use of language are not good intelligence tests for deaf children, because deaf children must learn language as a school subject, and ability to pass language tests depends primarily upon schooling. The inability of a deaf child to pass any specific language test might simply indicate his lack of school training and give us no measure of his intelligence.

To sum up, then, our tests should avoid as far as possible specific school information. They should present relatively new situations to the child.

2. *Increasing Ability at Successive Age Levels.* — Our test or scale of tests must show that ability increases from age to age among children. A group of average five-year-olds must show a better performance

than a group of average four-year-olds, and so on. If we are dealing with one test that can be given to children of several ages, then ability on the test must increase from age to age. As soon as there ceases to be a differentiation in ability between any ages, then the test ceases to differentiate the general intelligence of children of those ages.

This is based upon the fact that the ability of the individual increases from infancy to maturity, and that the average child shows a steady and reasonable increase in ability from year to year. And this is what we find to be the case either with single tests that can be applied to children of several successive ages or with groups of tests forming a scale. The six-year-olds do better that the five-year-olds, the seven-year-olds better than the six-year-olds, and so on. Obviously if a test or scale fails to show this increase, we can get no measure of the child.

3. *Agreement with Other Judgments of Intelligence.* — Our intelligence tests must agree with other judgments of the individual's intelligence. The world at large is continually passing judgment upon the intelligence of individuals and obviously there must be some agreement between the rating of an individual given him by the world and that given him by intelligence tests. This does not mean, of course, that there must be absolute agreement. If such were always to exist there would be then no need for our psychological tests. All that we require is a general agreement with the best judgments of the world.

Although, as we have said, people are being continually judged by their fellows, nevertheless, these judgments are often carelessly made and inaccurate.

Ordinarily such judgments are of no use and sometimes they are worse than useless. We can obtain valuable information, however, when we get ratings of a group made by several reliable judges. This, however, is difficult; more difficult and laborious than giving intelligence tests and, therefore, the test is justified, because it is quicker and more accurate than collecting the subjective judgments of reliable judges. We use these subjective judgments in making our scale. A teacher's estimate of the intelligence of her children should show some general agreement with the results of an intelligence test. Several teachers' combined estimates should show a greater degree of agreement. This amount of agreement can be measured by means of correlation and we speak of a positive correlation when such an agreement exists. A high positive correlation means a great degree of agreement.

Ordinarily teachers' estimates show a positive correlation, but they do not show an identical agreement with the results of the tests. The amount of agreement is sufficient, however, to indicate that the tests are measuring that which the world recognizes as general intelligence. The lack of perfect agreement indicates the inability of the teacher to pick out the one factor of general intelligence and to abstract from school knowledge, temperament, character and all those other qualities that enter into the totality of a child.

In the construction of intelligence tests it is, therefore, usual to correlate the results of the tests with school marks, with teachers' estimates of ability, with fellow students' or parents' estimates of ability, or with any other outside judgment of ability that may be available. All reliable tests have been subjected to this kind

of an analysis and particularly the Binet Scale. It has shown agreement with teachers' estimates, school marks and other judgments. It also agrees with such broad distinctions between the abilities of children within and without our feebleminded institutions, thus agreeing with the general opinion of the world which found such children to be feebleminded long before the advent of intelligence testing as a means of diagnosis.

And lastly, as various measures of intelligence become perfected, we can check up any new tests of intelligence by comparing the results with those obtained by more or less known and standard measures. The Binet Scale serves at present as one such standard measure. We must, however, avoid the assumption that the Binet Scale as it now exists is a perfect measure of intelligence, and therefore, demand that all other measures show a high degree of correlation with it. If we insist upon a high correlation, we should be merely duplicating measures that do for us what the Binet Scale is already doing, and we should be working in a circle without making any progress. As with the judgments of individuals or school marks, all that we can require is a moderate amount of agreement between any new scale and the older established scales as they exist at the present time.

4. *Reliability.* — For a test to be reliable means that the test must rate the child in the same way when applied at various times. Assuming conditions of giving and scoring the test and the condition of the child equal on both occasions, then we should expect the test to yield approximately the same result. If a test gives a certain mental age on one day, to be reliable we expect it to give about the same rating during the next

few days. Practice effects are likely to appear. These may be avoided by using a different form of the same test, if such is available. Our measure of reliability is the correlation between the same test given twice, or different forms of the test given on two separate occasions.

If we use these four criteria of any one test within a scale and of the scale as a whole, we may be fairly certain of arriving at valuable tests for the measurement of intelligence.

The Growth of Intelligence. — We assume that intelligence increases from birth to maturity, and that

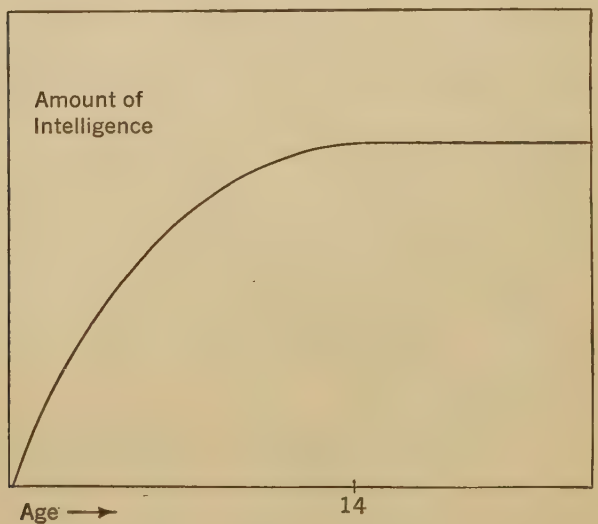


FIG. I

then it remains more or less constant, only to show decay and weakening during old age. We assume further that normally intelligence increases at a diminishing

rate from year to year during this period of growth, so that our conception of the growth of intelligence may be pictured as in Figure I.

From birth to five years there is the most rapid increase in intelligence. The annual increments are larger than during any other five-year period. During the next period from five to ten the growth is not so great but is still steady and easily measurable. During the next five-year period the growth becomes smaller and smaller, and many psychologists assume that a fourteen-year-old level on the Binet Scale is the level attained by the average adult. Some assume that the sixteen-year-old level is the average adult level. At present, it is customary to assume the fourteen-year-old level in view of the general results of the mental testing in the army, where it was found that the average recruit had a mentality about equal to a mental age of 13.8 on the Stanford Revision.

From age fourteen or sixteen onwards, therefore, our tests do not at present detect any growth of intelligence in the psychological sense, although it would not be safe to deny the possibility of such growth. It may be there, and may last on into the twenties or thirties but our tests may not be fine enough to detect it. Even if, on the average, such slight growth of abstract intelligence persists for some years after fourteen or sixteen, it is probably not of sufficient amount to be an important factor in the practical affairs of life.

Figure II shows hypothetical growth curves for superior, normal and inferior intelligence, with the suggestion that the curve for inferior mentality stops rising at an earlier age than that of normal mentality, and that the curve for superior mentality continues to rise

for a longer period. There seems to be no doubt that the intelligence growth of the feebleminded begins to slow up at an earlier age than that of the normal child.

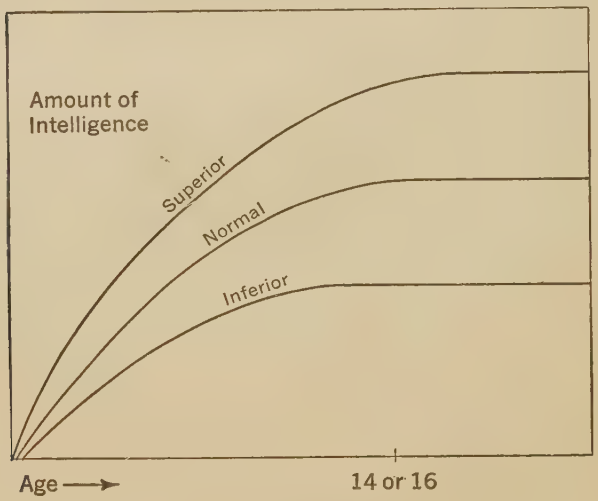
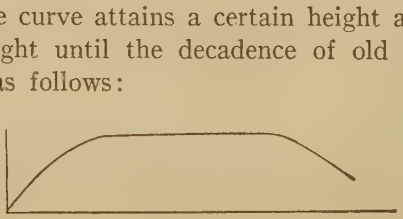


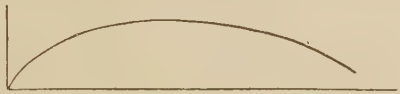
Fig. II

We have as yet no evidence with reference to those of superior mentality. Our figure represents only three curves, but we must imagine an infinite number representing all types of intelligence.

What form our curve of intelligence would take if continued to middle age and old age, we cannot tell. Perhaps the curve attains a certain height and remains at that height until the decadence of old age begins, somewhat as follows:



Or, perhaps, as soon as the curve attains its maximum, it immediately begins to descend somewhat as follows:



As soon as growth ceases, decay may set in, gradual and by degrees at present not measurable. This maximum may be much later than the empirical point at age 14 or 16 as shown by our present tests. All these questions are interesting problems for future research.

The Limit of Intelligence. — Ordinarily this assumption of the psychologist that the development of intelligence ceases between the ages of fourteen and sixteen, comes rather as a shock to students or teachers. They have been accustomed to think of a man's mind as increasing and developing until old age definitely sets in. They must remember, however, the definite and limited sense in which the psychologist is using the term intelligence. It is ability to adapt to relatively new situations. As far as he has been able to measure such adaptability he finds that average fourteen to sixteen-year-old children show as much adaptability as average adults, whatever their age may be. He does not mean that such children can do or know as much as the average adult. He simply means that, given a situation as new to the fourteen or sixteen-year-old as it is to the adult, on the average their performances will be about the same. What the individual acquires as he grows older is a greater and greater accumulation of facts, a greater knowledge, a wider experience of doing many different things appropriate to the level of his intelli-

gence. The adult knows many more things than the child, because he has had time to acquire such knowledge; he can do many more things because he has had experience in doing them. The depth of his knowledge and the extent of his experience is, however, all through life conditioned by the degree of intellectual development, the growth of which, we believe, ceases for all practical purposes about the age of fourteen or sixteen.

The Regularity of the Growth. — So far our pictures have shown smooth curves as it is easier for us to imagine the growth of intelligence as being regular from year to year as our curves indicate. There is no reason, however, to believe that this is necessarily true. It probably gives us a picture of the average of groups, but not necessarily of the individual. We must, therefore, widen our conception to include the possibility of irregular curves. Just how frequent these irregular curves are, we do not know. It seems that usually the growth of intelligence is constant and regular, but nevertheless there is no reason at present for denying the possibility of irregular and uneven development. The assumption of the regularity of the growth rests upon the stability of the Intelligence Quotient. The Intelligence Quotient or I. Q. is, as we shall see later, the ratio of the Mental Age to the Chronological Age. If this ratio remains constant the individual will maintain a steady development and his growth curve will be of the form we have pictured. If, however, the I. Q. fluctuates from time to time, then the growth will be spasmodic in character and the curve will deviate from the type we have pictured.

Rugg (21), Terman (19), Garrison (22) and others have shown that the average change in I. Q. from one

test to another is very small. Terman has also given the growth curves of several individual children and, while most of them are very regular, some are decidedly irregular. The fact that the average change in I. Q. for a number of children is very small, must not lead us to forget that there are many cases showing appreciable changes from one test to another. (Root, 22.) Some of these changes are certainly due to the inadequacy of the measuring instrument, the difference between examiners' methods, the failure of a subject to give full co-operation at all times, and the like, but some of them may also be due to irregularities of growth in intelligence. Such irregularities may be caused by severe illness and they will be probably more frequent among so-called unstable individuals. As a rule, however, growth in intelligence seems to proceed fairly uniformly from year to year without any marked fluctuations.

The Distribution of Intelligence. — Another basic assumption underlying intelligence testing is that the distribution of individuals with reference to general intelligence approaches a normal distribution. A normal distribution of individuals for any trait means that the majority of individuals possess a medium or average amount of the trait, that an equal number on both sides possess more and less of the trait in question, and that progress from average to very little or very much is marked by a gradually decreasing number of individuals. Figure III shows a picture of a normal curve, and a possible division into five different grades of intelligence is there pictured. The middle group of normal includes about fifty per cent of the cases. This group is flanked on each side by two groups called

superior and inferior, each containing about 22 per cent of the cases. And finally at the extremes we have two small groups designated very superior and very inferior, each containing about three per cent. Within each group

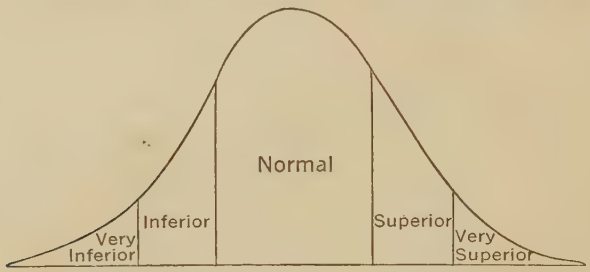


FIG. III

there are obviously differences in intelligence, but for practical purposes such a five-fold division may be all that is required. It is perfectly possible, however, to make more divisions and very often it is convenient to make a seven-fold division. Obviously we can make as many groups as is useful to our purpose, always keeping in mind the real power of differentiation that any particular set of tests may possess.

In actual practice no set of tests gives a perfectly normal distribution, although almost all groups of tested individuals seem to approach such a distribution the better our sampling of individuals becomes and the better our set of tests is constructed. It may be that the actual distribution of intelligence is not perfectly normal, that it is skewed slightly to the upper or the lower end of the curve, but with the comparatively rough intelligence measures that we possess at present the best assumption for practical purposes is that of a normal distribution.

The Ways of Expressing Intelligence Ratings. — There are many different ways in which we may express the intelligence rating of an individual, and we shall discuss some of those most commonly used at the present time.

1. *Mental Age.* — One of the most common and serviceable means of designating the intelligence of a child or of adults of inferior intelligence is by what is known as the Mental Age. This method originated with the Binet Scale, but is now used with any set of tests standardized on children of various ages. If a child is said to have a certain mental age, we mean thereby that his performance on the tests is equal to the average performance of a fair sampling of children of the same chronological age. Thus, if average five-year-olds are able to pass certain tests, a child regardless of his chronological age, who is able to pass these same tests and unable to pass any higher ones, is said to have a mental age of five years.

The validity of any mental age depends, of course, upon the thoroughness of the standardization of the scale from which the mental age is computed. It is, therefore, always necessary to keep in mind the scale upon which the child was tested and it is dangerous to compare the mental ages of children tested by different scales. The original Binet Scale was found to be too easy at the lower end and too hard at the upper end for average American children. A child having a mental age of three or four on this scale cannot, therefore, be properly compared with a child whose mental age is three or four as tested by the Stanford Revision of the Binet Scale. It is, therefore, always necessary to keep in mind the scale from which the mental age has

been computed. At the present time the Stanford Revision would seem to be the best standardized scale and it is the one most widely used. It may not be absolutely accurate and there is a possibility that the higher ages (12, 14, 16) are too hard for the average child of those ages, nevertheless constant use of the scale gives us a familiarity with its meaning and something like a conventional significance is being attached to the different mental ages on the Stanford Revision. They are beginning to stand for specific degrees of intelligence, even although they may not in every case actually measure the average ability of the age in question.

Although the concept of mental age is extremely useful and readily understandable in practical work, it has one grave drawback. This becomes at once apparent when dealing with adults who are not backward, or with very superior children. Because mental age means the average or median performance of a fair sampling of the equivalent chronological age group, we cannot really have a mental age above 14 or 16, if mental growth stops at these ages. In other words a mental age of 12 is equivalent to the average performance of twelve-year-olds; a mental age of 13 to the average performance of thirteen-year-olds; a mental age of 14 to the performance of fourteen-year-olds; a mental age of 15 to the performance of fifteen-year-olds; a mental age of 18 to the performance of eighteen-year-olds; a mental age of 20 to the performance of twenty-year-olds; and so on to any age. Now if mental growth ceases at 14, then the average performance of 14-, 15-, 16-, 18-, 20-, 30-year-olds must be identical. Therefore, we cannot go above a mental age of 14. Any individual

exceeding the score of the average fourteen-year-old has a mental age above 14, but that is really all we can say about his mental age. In order to assign mental ages to such individuals so as to be able to calculate I. Qs., many workers have assumed norms for higher ages above 14 or 16. In doing this, however, we should remember that these so-called mental ages are not based upon the strict meaning of mental age, as the average performance of the like chronological age group. Such mental ages are pure fictions and their comparability with true mental ages is doubtful. The mental age method is, therefore, limited in scope, hence other methods of rating intelligence, such as the percentile method or the standard deviation method, are coming into use, particularly in dealing with older individuals.

Mental age is an absolute measure of the child's accomplishment. The relative intelligence of the child can only be estimated by comparing his mental with his chronological age. The easiest comparison is to note how many years above or below his chronological age he may be. This, however, is very unsatisfactory because a difference of a certain number of years has a totally different significance at different periods of life. A four-year-old who is two years retarded mentally is much more seriously deficient than a twelve-year-old who is also two years retarded mentally. This is because the growth of intelligence is much more rapid at the earlier ages and gradually becomes slower and slower. Our previous discussion on the growth of intelligence has made this clear. Owing to this difficulty we must, therefore, adopt some other method of rating a child's intelligence, if we wish to compare the intelligence of children of different chronological ages.

2. *The Intelligence Quotient.* — The intelligence quotient gives us the relative degree of intelligence disregarding chronological age. It is the ratio of the mental and chronological ages. The mental age is divided by the chronological age and the quotient obtained is called the Intelligence Quotient or I. Q. Children testing exactly at age will all have I. Qs., of 1.00, those below age will have I. Qs., less than 1.00, and those above will have I. Qs., greater than 1.00. The Intelligence Quotient thus gives us an intelligence rating that makes possible direct comparison of children of different chronological ages. It is the most serviceable value when dealing with age-scales.

A study of the distribution of the I. Qs., of a large number of children, such as has been made by Terman (17) shows a fairly constant distribution at each age In his combined distribution for all ages from five to fourteen he gets the following results:

The lowest 1 per cent go to an I. Q. of 70 or below.
" " 2 " " " " " " " " 73 " "
" " 3 " " " " " " " " 76 " "
" " 5 " " " " " " " " 78 " "
" " 10 " " " " " " " " 85 " "

and so on.

The highest 1 per cent reach an I. Q. of 130 or above.
" " 2 " " " " " " " " 128 " "
" " 3 " " " " " " " " 125 " "
" " 5 " " " " " " " " 122 " "
" " 10 " " " " " " " " 116 " "

and so on.

The diagnostic significance of the different Intelligence Quotients is generally expressed somewhat as follows:

Intelligence Quotients	*Classification*
0–69	Feebleminded
70–79	Borderline
80–89	Backward
90–109	Normal
110–119	Bright
120–129	Very Bright
130 and above	Very Superior

Several methods for the rapid calculation of Intelligence Quotients are available. Tables for all I. Qs., within the mental age range of three to seventeen years and the chronological age range from five to seventeen years have been prepared by Inglis (22). Toops and Pintner (18) have devised a chart for reading off Intelligence Quotients. Yepsen (22) has devised a slide rule of the conventional type called the Vineland Slide Rule, while Kohs has constructed a circular slide rule, called the Reed I. Q. Slide Rule. The tables are undoubtedly the most accurate, but the other devices are rapid and may be useful where extreme accuracy is not necessary.

3. *Point Scales and Their Coefficients.* — If, instead of an age scale, we are using a scale on which a child is said to score so many points (see description of Yerkes-Bridges Scale in Chapter V), we obtain as a measure of his intelligence a score of so many points. We may then refer to the norms and turn this into a mental age and from this derive an I. Q. as explained above. Instead of this procedure, however, we have the

possibility of comparing the number of points obtained with the number of points normal for the age in question. The ratio of these two values gives a coefficient which has been called the Coefficient of Intellectual Ability (C. I. A.) or the Coefficient of Mental Ability (C. M. A.). This coefficient expresses the percentage of points gained with reference to the norm for the age in question. It cannot be directly compared with the I. Q. and the diagnostic significance must be empirically determined for the scale with which it is used. So far it has only been used with the Yerkes-Bridges Scale, and we shall give the diagnostic significance of the coefficient, as far as has been determined, when the scale itself is discussed.

4. *The Median Mental Age.* — When dealing with a number of standardized tests, each of which are significant for a wide range of ages, a very useful method of intelligence rating is the median mental age. Suppose we have fifteen tests showing significant scores or time values at most ages from five to fourteen, we can turn any particular child's score into the equivalent mental age for each test. We then have fifteen mental ages descriptive of his performance on the tests. The median of these fifteen mental ages gives us a mental age which can be regarded as the most likely mental age of the child. This mental age can then be converted into an I. Q.

This method of evaluating intelligence has been used by Pintner and Paterson with their Performance Scale (See Chapter V). The value of the method lies in the flexibility allowed the examiner with reference to the number of tests used in any particular case. Indeed a mental age of this kind can be obtained from any con-

glomeration of properly standardized tests which cover a sufficiently wide range of ages. Furthermore, the list of mental ages for the individual tests gives the examiner a picture or profile of the child's performance showing at a glance the tests or types of test in which the child excells or fails.

5. *Percentile Ratings.* — A type of rating that is becoming more and more popular among mental testers is the percentile rating. In this case the individual's performance is compared with the performances of all the individuals in a particular homogeneous group. A six-year-old is compared with a group of six-year-olds; a ten-year-old with a group of ten-year-olds; a college student with a group of college students or, if we like, with a group of miscellaneous adults. The reference always is to a group of which the individual is in some way a member. We do not compare a five-year-old's performance with the average performance of children of different ages and find that it is like the average performance of six-year-olds or seven-year-olds. We compare his performance with five-year-olds only and find out whether it is equal to the performance of 10 per cent, 20 per cent, 50 per cent or any per cent of five-year-olds. This percentile value is the measure of his ability and it is easy to interpret. It ranks him immediately on a scale of one hundred. It tells us how many are above or below him, and we can then describe his ability in any way we wish in accordance with whatever sub-division of groups we have carried out on our normal curve of distribution.

The percentile method can be used with a group of tests each of which has been standardized according to percentiles. In this case we shall have a percentile

rating for each test and the median or average of these percentiles will be the intelligence rating of the child.

This method has been used by Woolley (15) in her tests for adolescents and also by Pintner (18). The latter shows the necessity of "super-percentile" tables for the accurate interpretation of an average or median derived from several percentile ratings. On the other hand we may have a series of tests each of which is assigned a score, and the total score will then be converted into a percentile which will give the individual's rating.

The percentile method has found particular favor with group tests. This is probably owing to the fact that it demands a large number of cases in order to give a reliable standardization. It is unquestionably one of the best methods of expressing an intelligence rating and its use will become more common in the future. With percentile norms for each age group we avoid the necessity for comparing subjects of one chronological age with those of another, a procedure which Chapman and Dale (22) have recently criticized. They question the practice of rating a precocious nine-year-old on tests devised for twelve-year-olds. "A child of 8 and a child of 12 cannot be compared." They believe that finally the mental age and the Intelligence Quotient must be abandoned.

6. *Age Variability Unit.* — Probably the best intelligence rating and the one that will be extensively used in the future is a rating which expresses the standing of the subject with reference to the standard deviation of the group with which he is to be compared. The advantage of any standard deviation unit over a percentile rating is that the standard deviation units are

equal at all points of the difficulty scale. The differences between any two percentile ratings are not equal, because differences increase as we go out from the median either upwards or downwards.

McCall (22) has worked out the so-called T Scale by using as the unit of measurement one-tenth of the standard deviation of twelve-year-old children. Pintner (21) has standardized his tests in much the same fashion, but has constructed a separate scale from the distribution of the scores at each age, and he has called the units of measurement Mental Indices. The reader who is interested in the technique of such scale construction will find it adequately described by McCall (22).

7. *Combined Attainment and Intelligence Ratings.* — Although it is not the purpose of this book to discuss educational tests, we must call attention to the devices that are coming into use for evaluating educational attainment in terms of intelligence. Pintner (21) has employed the mental index (S. D. method) for both his intelligence and educational tests and is therefore able to measure achievement in terms of ability by merely subtracting the indices. Hence his "Difference" is such a measure.

Franzen (20, 22) has worked on mental age procedure and has suggested educational ages (E. A.) for any particular educational test. Thus we may have an arithmetic age, spelling age, and the like as a measure of a child's ability and these ages are determined from educational tests in the same way as mental ages are determined from intelligence tests. The E. A. (educational age) divided by the C. A. (chronological age) gives an E. Q. (educational quotient), just as an M. A. divided by a C. A. gives an I. Q. The ratio of E. Q.

to I. Q. gives an accomplishment quotient or A. Q. The ratio of E. A. to M. A. gives of course the same thing. This Accomplishment Quotient is a measure of the educational attainment of the child in terms of his intelligence.

Special groups of tests for such combined procedures will be discussed in Chapter VI, and the practical results obtained in school work in Chapter XI.

Standardization

By standardization we mean the establishment of a certain definite method of giving a test and the establishment of adequate norms for the interpretation of the results. The former may be called standardization of procedure and the latter standardization of results.

Standardization of Procedure. — It is imperative in giving a test to give it in as nearly as possible the same manner in which the test was originally given, that is, of course, if we wish to compare our results with those of the originator or if we wish to measure the intelligence of a child by means of some recognized test. Many conflicting differences in the results of different workers may be traced directly to slight differences in procedure. Just how significant a slight change in procedure is going to be can never be foretold. We must actually try out the difference before we can tell what influence it will have. Therefore, when we are using a standard scale for practical results, we must be very careful to follow exactly the procedure as laid down by the author. We may think it would be better to present a test in this or that fashion, and it may really be so, but we must remember that if we do so, we may

be changing the test and we cannot, therefore, use the norms which the author of the scale has arrived at. To be sure by making a certain change, we may make a much better test, but if we do that, we must remember that it is a *new* test and before using our results we must prepare *new* norms by which to interpret them.

All of this sounds trite and commonplace to the psychologist, but it is something that cannot be too strongly impressed upon the beginner in intelligence testing. The teacher in particular, who is learning to give intelligence tests, must keep this in mind, because her whole attitude in the class room is one of adapting the presentation of a subject to her pupils and in doing so the good teacher turns it around and presents it from many different angles, so as to reach many different grades of intelligence. She shows her initiative by doing this and she is quick to perceive when a child does not grasp the point, and ready to give the subject just a little turn to bring it within the focus of his intelligence. It often happens, therefore, that in presenting a mental test she grasps at once the difficulty that the child is experiencing and knows what slight modification of the presentation would bring it within his range, and the temptation to do this is great. The teacher must, however, resolutely withstand any such temptation, because she must remember that, if her slight modification had been made and so given to all the children upon which the test has been standardized, the norms would have been very different from what they now are. The teacher or examiner must remember that she is not teaching but testing the child.

Standardization of Results. — By this we mean the establishment of adequate standards or norms by means

of which the result of testing any individual case can be properly interpreted. It is, of course, necessary to give our test or tests to a sufficiently large number of cases before we can be sure of having arrived at a true average or median. Many tests are of doubtful practical value, because they have not been tried with enough cases to warrant any confidence in the averages or medians secured. It is difficult to say just how many cases must be tested before a satisfactory standardization can be reached. Perhaps the most satisfactory method to pursue is to work out the age or percentile norms at different stages in the standardization, and note whether the averages, medians or percentiles fluctuate much or little as each new group of cases is added. After testing say fifty children, work out the norms. Add another group of fifty or so, and work out the norms again; and so on with additional increments, until a general tendency for the norm to remain stable is noticed. The presumption then is that the addition of more cases will not materially alter the norm and we may regard our standardization as complete.

In this work of standardization our constant endeavor is to get a fair sampling of cases at each age. By a fair sampling is meant a group which will represent in proper proportions all the different types of intelligence contained within the large group. Obviously we must be content with a sampling of any group. To determine the intelligence of the normal American citizen, we cannot test all the one hundred million inhabitants of the United States. To arrive at the ability of six-year-olds on some given test, we cannot test all the six-year-olds in the United States. Nor is it really necessary to do this. All that we need is a fair samp-

ling of six-year-olds. Theoretically it is very difficult to decide as to what a fair sampling of any group is, and we might enter into a lengthy critique of almost all standardized tests from the point of view of a fair sampling and it would not be difficult to find fault with most standardizations. Such theoretical exactness must not be allowed to stand in the way of the practical work of gathering results to arrive at standards. What the psychologist ordinarily does is to use the ordinary school child, and if he gets a fair mixture of city and rural children, the probability is that he will obtain a fair sampling.

In using elementary school children for the lower ages the psychologist realizes that the most defective cases have been eliminated, because the idiots are almost always in institutions or at home; similarly in the more progressive states the majority of imbeciles are likewise eliminated from the school. On the other hand the brightest children are not automatically eliminated in this manner. Whether this discrepancy between the lower and upper end of our distribution will seriously injure the ordinary standardization is doubtful.

When we come to the higher ages, say thirteen and above, the difficulty of getting a fair sampling is greatly increased. The larger number of children leave school at the age of fourteen and a great many drop out even before that age. Those that remain belong, in the main, to the wealthier classes and these classes are endowed on the average with more intelligence than the poorer classes. Furthermore, children of mediocre or inferior intelligence, of whichever class, tend to drop out of school sooner than their better endowed fellows. Such children find they cannot keep up the pace set in the

High School, they become uncomfortable and restless, and leave school in order to find a more congenial environment. All standardizations for these higher ages, which are based upon school children entirely, lead in all probability to norms that are too high for the population in general. In the Stanford Scale a splendid attempt was made to arrive at average adult intelligence and it was thought to correspond to the ability of sixteen-year-old students (mostly High School). The testing of thousands of average adults in the army leads us to believe that the Stanford tests for age fourteen are more nearly adequate measures for the average American adult. This illustrates the difficulty of getting a fair sampling of children at each age, particularly in the higher ages.

The further we progress in intelligence testing the more clearly do these difficulties of obtaining a random or unselected group of cases emerge. The wide application of intelligence tests to all types of people and in all types of communities has revealed individual differences far greater than were thought to exist. Different sections of a city differ greatly in intelligence and so do different rural communities. We find differences in the average intelligence of the inhabitants of different small towns and the same is probably true of cities, and of states and larger sections of the country. The existence of such differences need not dismay us nor make us give up as hopeless the standardization of intelligence tests, but the knowledge that they exist should at least keep us from being dogmatic and from regarding any scale as being a complete and final measuring rod of intelligence.

Having obtained results from as fair a sampling as

possible, they will now be used by the psychologist in different ways according to the type of scale he is standardizing.

Age Scales. — For age scales of the Binet type, where each test is either passed or failed, the results will consist of the percentage of children at each age who have passed a given test. The test must fulfill the criteria we have laid down above and is said to be standard for the age at which about 75 per cent (roughly sixty to eighty per cent) pass. The assumption is that the middle fifty per cent and also the upper twenty-five per cent will pass the test, making in all about 75 per cent. Actually in the Stanford Revision we find these percentages running from about 60 to about 80.

Point Scales. — Here our results will consist of the total number of points scored by each child and the norms will be expressed by the average or median number of points for each age. This average must show a steady rise from age to age.

Median Mental Age. — Here the results will consist of some kind of a score or time value. The median score for each age is determined and a test has discriminative value for that range of ages which shows a progressive increase in score.

Percentile Ratings. — The scores of all the cases at each age are arranged in order of merit and percentiles calculated. We may calculate as many different percentiles as we wish. The more percentiles we calculate, the larger the number of cases must we possess in order to have a reliable standardization. Because of the fact that we take account of extreme low and high values, which are later to be used as diagnostically significant, the percentile method requires more cases

for an adequate standardization than do the other methods. Each percentile should show a progressive rise in score as we go from age to age.

Examples of all these different kinds of standardizations will be shown when we deal with the actual scales.

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PART II

THE METHODS

CHAPTER V

THE SCALES

This chapter will give a brief account of the various scales used for individual testing, with comments upon each. It is impossible to give all the necessary directions for the use of each scale. Those who desire to use any scale in actual testing must go to the original source and follow explicitly the directions of the author. No attempt will be made to describe the innumerable intelligence tests that have not been combined in some way or other into a scale. By a scale we mean a group of tests used in some special manner for the purpose of obtaining an intelligence rating, generally a mental age. By means of a single test we do not attempt to arrive at a mental age, although many single tests are of great help and form useful additions to the ordinary equipment of the psychologist. For a description of such tests, the reader must be referred to Whipple's Manual of Mental and Physical Tests, which is a storehouse of information with regard to them. The purpose here, however, is to describe what we have designated " scales " in contradistinction to tests.

I. The Binet Scale

(*a*) *The 1905 Scale.* — The first appearance of the tests, familiar to us now as the Binet tests, was in the series of tests published in 1905, which we have called

the 1905 Scale. Strictly speaking, it is not a scale in the later sense of that term. The tests are not grouped into age groups, but they are arranged in order of increasing difficulty. Below is printed a short description of the tests:

1. "Le Regard." Ability to follow with the eyes a moving object. A lighted match is slowly moved before the eyes to see if the child can follow the movement.
2. Prehension Provoked by a Tactile Stimulus. A piece of wood is brought into contact with the palm or back of the hand to see if the child will seize it without letting it fall and carry it to his mouth.
3. Prehension provoked by a Visual Stimulus. Cube of wood shown merely.
4. Recognition of Food. Present a piece of chocolate and a piece of wood.
5. Quest of Food Complicated by a Slight Mechanical Difficulty. Candy wrapped up in paper.
6. Execution of Simple Commands and Imitation of Simple Gestures.
7. Verbal Knowledge of Objects. Parts of the body and familiar objects.
8. Verbal Knowledge of Pictures. Ask where the things are on the picture.
9. Naming of Designated Objects. Common Objects on a picture must be named by the child.
10. Comparison of Two Lines. The child must tell which is the longer.
11. Repetition of Three Digits.
12. Comparison of Two Weights. Compare 3 and 12 grams.
13. Suggestibility. Asking for objects that are not present; for things on the picture by a nonsense word; comparison of lines, three unequal and last three equal.

14. Definition of Objects.
15. Repetition of Sentences.
16. Comparison of Two Objects. The difference between a fly and a butterfly, etc.
17. Memory for Things in a Picture. Thirteen common objects shown in a picture for thirty seconds, after which child repeats as many as he can.
18. Drawing a Design from Memory. Two designs are shown for 10 seconds, after which the child tries to draw them.
19. Repetition of Digits.
20. Resemblance of Known Objects. In what way are a poppy and blood alike? etc.
21. Comparison of Lengths of Lines.
22. Comparison of Weights.
23. Memory for Weights. After the blocks have been correctly placed in order of weight in Test 22, one is taken away and the subject must find out where the gap is.
24. Rhymes. Find rhymes to a given word.
25. Completion of Sentences. Find the right word to complete a sentence.
26. Makes up a Sentence including Three Given Words.
27. Comprehension of Questions. There are 25 questions from very easy to very hard.
28. Reversal of the Hands of a Clock. To be done from memory.
29. Paper Cutting. Paper folded twice and triangular piece cut out. Subject must draw result when paper is opened out.
30. Definitions of Abstract Terms.

Although Binet did not divide these tests into age groups, he gave general indications as to how far normal children of certain ages should go in the tests, e.g.,

age three up to about Test 9; age five up to about Test 14. Beyond this he suggests the range in different types of tests for various ages. In like manner he suggests only roughly the diagnosis of various degrees of feeblemindedness by means of these tests.

(*b*) *The 1908 Scale.* — Here the improvement over the previous scale lies in the fact that the tests are now grouped into years. It is the first age-scale.

AGE III

1. Pointing to Nose, Eyes and Mouth.
2. Repetition of Short Sentences.
3. Repetition of Two Digits.
4. Enumeration of Objects in Pictures. The pictures are the Peddler and Boy; The Old Man and Woman on a Bench; The Man Standing on a Couch Looking Out of a Window.
5. Knows his Last Name.

AGE IV

1. Knows Sex.
2. Names Familiar Objects.
3. Repetition of Three Digits
4. Knows Longer of Two Lines.

AGE V

1. Compares Two Boxes of Different Weight.
2. Copies Square.
3. Game of Patience. Rectangular card cut diagonally to be reconstructed according to a similar uncut card placed before the child.
4. Counts Four Coins.
5. Repeats a Sentence of Ten Syllables.

Age VI

1. Knows Right and Left.
2. Repetition of a Sentence of Sixteen Syllables.
3. Esthetic Comparison. Choose the prettier of three pairs of faces.
4. Definition of Familiar Objects.
5. Executes Three Commissions.
6. Knows Age.
7. Distinction between Morning and Afternoon.

Age VII

1. Unfinished Pictures. Tells what is missing.
2. Number of Fingers. Knows number on each hand and on both hands without counting.
3. Copy of a Written Model.
4. Copies a Diamond.
5. Repetition of Five Digits.
6. Description of Pictures.
7. Counts 13 Coins.
8. Knows Names of Four Common Coins.

Age VIII

1. Reads a Passage and Remembers Two Items.
2. Counts Nine Coins.
3. Names Four Colors. The four primary colors.
4. Counts Backwards from 20 to 0.
5. Writes from Dictation.
6. Comparison of Two Objects. Differences.

Age IX

1. Knows Date. Day of week, day of month, month and year.
2. Repeats Days of Week.
3. Makes Change.

4. Definitions Superior to Use.
5. Reads a Passage and Remembers Six Items.
6. Arranges Five Boxes in Order of Weight.

Age X

1. Repeats the Months of the Year.
2. Knows the Names of Nine Pieces of Money.
3. Uses Three Words in One Sentence.
4. Comprehension of Common-Sense Questions (Easy).
5. Comprehension of Common-Sense Questions (Difficult).

This last test Binet calls a transitional test between ages ten and eleven.

Age XI

1. Criticizes Absurd Statements.
2. Uses Three Words in One Sentence.
3. Names Sixty Words in Three Minutes.
4. Defines Abstract Words.
5. Disarranged Words Arranged into a Sentence.

Age XII

1. Repetition of Seven Digits.
2. Finds Three Rhymes for a Given Word.
3. Repetition of a Sentence of 26 Syllables.
4. Explains Problem Questions.
5. Interprets Pictures.

Age XIII

1. Paper Cutting. Described in 1905 Scale, Test 29.
2. Reversed Triangle. Rearranges two triangles in imagination and draws results.
3. Differences between Pairs of Abstract Terms.

The 1908 Scale divides the tests into age groups and this is the most significant advance over the 1905 Scale. In addition the number of tests has now increased from thirty to fifty-nine for ages three to thirteen. These do not include the first six tests of the 1905 Scale suitable for infants. In addition a few of the others have been dropped, e.g., Tests 9, 17, 20, 21, 23, 28. The method of giving several of the tests has been radically changed, and a great many new tests have been introduced. These changes and additions represent the result of the practical application of the 1905 Scale to many children. It is interesting to note the introduction of several tests depending more directly upon school knowledge, although Binet was evidently aware of the undesirability of that type of test. The following footnote of his is interesting: "These tests are not the first ones of which we had thought; if we keep them, it is after long trial; they appear to us all good and practical. But we are far from claiming that they are the best. Those who will take up this work after us will find better; they will certainly succeed in eliminating more strictly than we have been able to do, the tests that are influenced by education." (Binet and Simon, 16, Kite translation).

The 1908 Scale is also important, because in reference to it, Binet explained the method of calculating mental age for the first time. Briefly, a child who passes all or all but one of the tests of any age group is credited with that mental age to begin with (now commonly called the basal age). To this age is added as many years or fractions of years as he is entitled to for tests passed above his basal age, five or six additional tests being counted roughly as a year. This method of calculation is suggested by Binet and is used only in an ap-

proximate manner, without any of the niceties of present-day calculation. As a matter of fact he designates his cases as being so many years advanced or retarded and his smallest unit is a half year.

It was this 1908 Scale that was first introduced into this country and all the early work was done on this scale or on modifications of it. We shall, however, neglect these American modifications in the meantime and discuss Binet's final Revision of 1911, because all the useful American revisions at present have taken into account the changes made by Binet in the 1911 Scale.

(*c*) *The 1911 Scale.* — This was the result of two or three years' work on the 1908 Scale and the slight changes made arose from the criticisms of Binet and his co-workers. Binet tells us that he has omitted several tests which depend upon the scholastic ability of the child, such as reading and writing; also certain tests which are matters of knowledge dependent upon the environment, such as age, days of the week. In addition some tests were found too hard for the age at which they were placed and these have been moved, and a few new tests have been introduced. All tests for Age XI have been omitted and most of them moved to Age XII. Age XII and Age XIII become in effect Age XV and Adult. We also note that there are now five tests at each age, except at Age IV, where there are only four. Ages III, IV and V remain the same as in the 1908 Scale. For detailed description of tests, see Binet, A., and Simon T. (11 and 16), translations by Town and Kite respectively.

Age VI

1. Distinguishes Morning and Afternoon.
2. Defines Words in Terms of Use.
3. Copies a Diamond.
4. Counts 13 coins.
5. Esthetic Comparison.

Age VII

1. Knows Right and Left.
2. Description of Pictures.
3. Executes Three Commissions.
4. Gives Value of 3 Single and 3 Double Sous.
5. Names Four Colors.

Age VIII

1. Comparison of Two Objects. Differences.
2. Counts Backwards from 20 to 0.
3. Unfinished Pictures.
4. Knows Date.
5. Repetition of Five Digits.

Age IX

1. Makes Change.
2. Definitions Superior to Use.
3. Knows Value of 9 Pieces of Money.
4. Repeats the Months of the Year.
5. Comprehension of Easy Common-Sense Questions.

Age X

1. Arranges Five Boxes in Order of Weight.
2. Copies Two Designs from Memory.
3. Criticizes Absurd Statements.
4. Comprehension of Difficult Common-Sense Questions.
5. Uses Three words in Two Sentences.

AGE XII

1. Resists Suggestion (length of lines).
2. Uses Three Words in One Sentence.
3. Names Sixty Words in Three Minutes.
4. Defines Abstract Words.
5. Disarranged Words Arranged into a Sentence.

AGE XV

1. Repetition of Seven Digits.
2. Finds Three Rhymes for a Given Word.
3. Repetition of a Sentence of 26 Syllables.
4. Interprets Pictures.
5. Explains Problem Questions.

ADULT

1. Paper Cutting.
2. Reversed Triangle.
3. Three Differences between a President and a King.
4. Differences between Pairs of Abstract Terms.
5. Gives Sense of a Passage from Hervieu.

These three scales show the progressive development of the idea of measuring intelligence by age steps. From the first series of tests arranged in order of difficulty we proceed to the arrangement of tests according to age and then to the better standardization of each test according to age and to a uniform number of tests for each age. The tests themselves do not change materially from scale to scale. The conglomeration of tests has justified itself from the beginning as a reliable instrument for measurement, and in the successive revisions we see Binet at work adjusting more nicely his measuring rod. Had Binet lived longer, he would undoubtedly have continued adjusting it in order to measure still more accurately.

II. Modifications of the Binet

As soon as Binet's work became known numerous investigators started to try out his method and naturally enough began to suggest various changes. It would be futile and unprofitable to attempt to record all the suggested changes. Many were stupid and made by individuals who had merely read Binet's articles or, still worse, meager translations or accounts of the scale, and, without experimenting themselves, felt called upon to pronounce judgment and to dictate how things should be done. From serious workers came many valuable criticisms which were all more or less taken account of by the chief revisions that were made later. We shall describe here a few of the more important revisions and modifications of the Binet, which have been used in America.

(*a*) *The Goddard Revision.* — Goddard (11) was the first to introduce the Binet Scale into America and for a long time his Revision, first published in 1910, was the one most commonly used and the best standardized. In his standardization on American children he found many tests misplaced in the French Scale and, therefore, some change occurs in the position of some of the tests. He, of course, made all the necessary changes in order to adapt the tests to American conditions. He chose different pictures from those used by Binet, and introduced a few new tests.

The importance of the Goddard Revision is due to the fact that it was the first well-standardized scale for American children, and from his work with the feeble-minded he gave us tentative diagnostic limits on his scale. These limits at first were that two years re-

tardation was probably indicative of feeblemindedness. Later on these limits were revised to read two years retardation below age nine and three years above that age. In calculating mental age the method of Binet was followed, but it was more rigidly carried out and fractions of a year were now used. The method employed by Goddard was to allow a year for any five tests passed above the basal year as Binet had done, and in addition any extra tests were indicated by an exponent. Thus a child having passed all the 8-year tests and also three 9-year tests would be given a mental age of 8^3, the exponent 3 indicating three-fifths of a year. Little use was made of the XV and Adult tests, and the standardization at these ages was very unsatisfactory.

(*b*) *The Kuhlmann Revision.* — Two revisions of the Binet Scale have been published by Kuhlmann (12 and 22). The first one adhered closely to the original Binet Scale, while the second one, published ten years later, introduced a great number of new tests. The general nature of the 1922 Kuhlmann Revision may be described as follows: elimination of nineteen of the original tests because they were found to be unsatisfactory; increase of the number of tests to eight in each age-group above two years; extension of the original scale at both upper and lower ends. There are 129 tests in place of the 56 tests of the original scale.

The most original contribution of Kuhlmann's is the standardization of tests for children below the age of three. Some such tests were proposed by Binet in the 1905 Scale, but they were few in number and unstandardized. We give below Kuhlmann's tests for children below the age of three:

Age Three Months

1. Carrying hand or object to mouth.
2. Reactions to sudden sound. (Clap hands, etc.)
3. Binocular co-ordination. (Moving candle.)
4. Turning eyes to object in marginal field of vision.
5. Winking at an object threatening the eyes.

Age Six Months

1. Balancing head. Sits upright.
2. Turning the head towards a source of sound.
3. Opposing thumb in grasping.
4. Prolonged holding of object placed in hand.
5. Reaching for seen objects.

Age I

1. Sitting and standing.
2. Speech (Imitates ba, dada, mama, etc.).
3. Imitation of movements (Shakes rattle, rings bell, etc.).
4. Marking with pencil (Imitation).
5. Recognition of objects. (Shows preference.)

Age Eighteen Months

1. Drinking from a glass. (Several swallows.)
2. Feeding with spoon or fork.
3. Speech (mama, papa, baby, yes, no, cat, man).
4. Spitting out solids.
5. Recognition of objects in pictures.

Age II

1. Pointing out objects in pictures.
2. Imitation of simple movements. (Raise arms, clap hands.)

3. Obeying simple commands. (Catch ball, throw ball, etc.)
4. Copying a circle. (Any rough circular movement.)
5. Removal of wrapping from food before eating.

The mental age on the Kuhlmann is calculated in the usual way. In all ages above Age II there are eight tests. Each test passed, therefore, counts as one eighth of a year. A useful table for converting mental age as expressed in years and eighths into I. Qs. is given by the author. Kuhlmann's general interpretation of the significance of the various I. Qs. is as follows:

Grade Terms	*Range in I. Q.*
Idiots	0–24
Imbeciles	25–49
Morons	50–74
Borderline	75–84
Dull	85–94
Average	95–104
Bright	105–114
Very Bright	115–124
Superior	125–149
Very Superior	150–174
Precocious	175 and over

(*c*) *The Point Scale.* — The Point Scale for Measuring Mental Ability is the work of Yerkes (15), Bridges and Hardwick. Although making use of the original Binet tests, it is avowedly different in method. With reference to the original Binet Scale one of the authors says, " We now are fully convinced that it has served its most important purpose and must shortly give way wholly to a superior method." In view of

the later development of the Stanford Revision of the Binet Scale, which follows the method of the original Binet, the above prediction of Yerkes has not been fulfilled.

The authors of the Point Scale seem to have objected to two things in the original Binet system, namely, the grouping of tests into age-groups and in the system of scoring a test either right or wrong without allowing any partial credit. The latter system they call the "all or none" method of giving credit, and in its place they have developed a system of partial credits according to the number of items in a test that are answered correctly. The result of these two changes is that the characteristic grouping of tests of the Binet Scale into different age groups now disappears, and in its place appears a list of tests, all of which are to be given to each child examined, and for each of which a certain amount of credit or a certain number of points is allotted. The total number of points achieved by any individual gives the intelligence rating of that individual.

The point system, i.e., the system of giving varying amounts of credit according to the quality of the performance, is unquestionably very useful and perhaps fundamentally the ideal system in mental testing. It forms the basis of almost all our group methods of mental testing. Ideally, however, it presupposes a test in which the poorest can score just a little and the very best not quite the maximum. Many group tests fulfill this condition for a certain definite range of ages. The application of this system to tests of the Binet type results merely in a system of partial credits, for very few of the Binet tests cover a wide range of ages. Tests such as choosing the prettier of two pictures, or detect-

ing missing parts are obviously suitable for young children; the tests of dissected sentences or of drawing designs from memory are limited to older children. A point system of rating demands, however, that we give every child a trial on all the tests, because his score represents his total achievement on the whole scale. The consequence is that a point scale, using tests of the Binet type, involves much useless testing. For such tests the original Binet system of age-groups is unquestionably the best, unless we adopt a modified point system such as the one constructed by Herring to be described later.

The Point Scale consists of twenty tests, beginning with very easy tests, such as "choosing the prettier of two pictures," and continues to harder tests, such as definitions and analogies. All of the tests, except the analogies, are modifications of the original Binet tests. After each test has been given the credits obtained by the subject are noted in a special column of the test blank. At the end of the examination the total credits obtained form the basis of the mental rating. The maximum possible is 100. The average score per age for English-speaking children is given by Yerkes (16), as follows:

Age	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Average Score	15	22	28	35	41	50	58	64	70	74	79	81	84	86	88

By the use of the table any score can be converted into an equivalent mental age, reading either to the nearest mental age or making as fine an interpolation as is desirable. To interpret the score Yerkes recommends the Coefficient of Intellectual Ability (C. I. A.). This coefficient is arrived at by dividing the score ob-

tained by the standard score for the chronological age of the subject examined. Thus, a score of 20 made by a five year old would give a C. I. A. of 20/22 or .91. The same score made by a six year old would give a C. I. A. of 20/28 or .72, and so on. These coefficients and the mental age equivalents of any score are most rapidly and accurately obtained from a chart such as the one published by Pintner and Toops (17).

The diagnostic significance of the C. I. A. or the C. M. A. (Coefficient of Mental Ability), as it is sometimes called, is given as follows by Yerkes:

Coefficients	*Diagnosis*
.50 or less	Dependent
.51– .70	Inferior
.71– .90	Subnormal
.91–1.10	Normal
1.11–1.30	Supernormal
1.31–1.50	Superior
1.51–	Genius

Pintner and Toops in connection with their chart give the following diagnostic limits of the C. M. A.:

Diagnosis	*Coefficients*
Feebleminded	0– .74
Backward	.75– .89
Normal	.90–1.10
Bright	1.11–1.25
Very Bright	1.26 and over

The standardization of the scale is good. It was in fact so superior to the standardization of most scales in use at the time of the appearance of the Point Scale,

that from that time on, until the appearance of the Stanford Revision, the Point Scale was used by many psychologists. The superior standardization of the Stanford Revision and its wider range of applicability has resulted in little use of the Point Scale at the present time. We must not forget, however, that the Point Scale has proved of decided value, and that it stimulated thought and experimentation on the method of scale construction.

(*d*) *The Stanford Revision.* — The Stanford Revision of the Binet Scale by Terman and his co-workers is, as its name indicates, an extension, elaboration and thorough revision of the original Binet Scale. A guide for the use of the Scale appeared in 1916 (Terman, 16), and an account of its construction appeared in 1917 (Terman, 17), but historically we note its beginning in 1910 when Terman (12) and Childs began their critical evaluation and tentative revision of the Binet 1908 Scale. From 1910 onwards till the year of publication mentioned above, Terman and his co-workers were at work upon the scale and ultimately produced the Stanford Revision. No other scale has had such a thorough and extensive foundation.

The Binet tests of both the 1908 and 1911 scales form the foundation of the work and the Binet methods of age-grouping and calculation of mental age have been retained. The original Binet tests have, however, been made much clearer and many ambiguities in procedure eliminated. Many new tests have been introduced, "counting both regular and alternative tests, the revision contains 90 tests, as contrasted with 54 in the Binet 1911 Series" (Terman, 17). The placing of tests at the proper age has been more carefully worked out

than in the original Binet or in any of the other revisions. The device of having six tests in each age group has made the calculation of mental age at once simpler and also more accurate. Furthermore, a very definite attempt was made to standardize the scale as a whole so that the average child at each age would test exactly at age. This lack of adjustment of the scale as a whole was very noticeable in the original Binet and in the Goddard Revision, so much so that an average three year old tested more than three mentally and an average eleven year old more than eleven.

The data used in the Stanford Revision include 2060 examinations. All tests before being admitted into the scale were carefully scrutinized as to their validity. Terman (17) says, "there are three criteria which a test must satisfy before it can be accepted as a valid measure of intelligence."

1. Age Increase. A test must show an increase in the percentage of children that pass it from year to year.
2. Coherency. A test must be coherent with the scale as a whole; it must be measured up against the entire scale. This is shown by the percentages of dull, normal and bright children, as diagnosed by the whole scale, that pass each particular test. It is a question of the extent of the correlation between each test and the whole scale.
3. World Success. A test, or rather a scale of tests, must show a certain amount of agreement with the rating of an individual's intelligence, such as is reflected by his success in the world, by his success in school, by judgments of his intelligence by teachers and friends.

These are three criteria mentioned by Terman, and we have discussed them or similar ones more fully in

another chapter. They are worthy of mention here, however, so that we may fully appreciate the conscious application of principles underlying the Stanford Revision.

A summary of the tests in their age-grouping is as follows: *

Year III

1.* Points to parts of body — nose, eyes, mouth, hair.
2.* Names familiar objects — key, penny, knife, watch, pencil.
3.* Pictures — enumeration.
4. Gives sex.
5. Gives last name.
6.* Repeats 6–7 syllables — (*a*) I have a little dog. (*b*) The dog runs after the cat. (*c*) In summer the sun is hot.

Year IV

1.* Compares lines.
2. Discrimination of forms.
3.* Counts four pennies.
4.* Copies square.
5.* Comprehension. What must you do (*a*) When you are sleepy. (*b*) When you are cold. (*c*) When you are hungry.
6. Repeats four digits. 4-7-3-9; 2-8-5-4; 7-2-6-1.

Year V

1.* Comparison of weights, 3 and 15 grms.
2.* Colors. Red, yellow, blue, green.
3.* Esthetic comparison.

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4. Definitions, use or better. Chair, horse, fork, doll, pencil, table.
5. Patience, or divided triangle.
6.* Three commissions. Puts key on chair, brings box, shuts door.

Year VI

1.* Right and left. R. hand; L. ear; R. eye.
2.* Mutilated pictures.
3.* Counts 13 pennies.
4.* Comprehension. What's the thing to do:
   (*a*) If it is raining when you start to school?
   (*b*) If you find that your house is on fire?
   (*c*) If you are going some place and miss your car?
5. Coins. Nickel, Penny, Quarter, Dime.
6. Repeats 16–18 syllables.
   (*a*) We are having a fine time. We found a little mouse in the trap.
   (*b*) Walter had a fine time on his vacation. He went fishing every day.
   (*c*) We will go out for a long walk. Please give me my pretty straw hat.

Year VII

1.* Fingers. Number on R. hand; L. hand; both.
2.* Pictures, description or better.
3. Repeats 5 digits. 3-1-7-5-9; 4-2-8-3-5; 9-8-1-7-6.
4. Ties bow knot. Model shown. Single bow half credit.
5.* Gives differences. (*a*) fly and butterfly, (*b*) stone and egg, (*c*) wood and glass.
6.* Copies diamond.

Year VIII

1. Ball and field. (Inferior plan or better.)
2.* Counts backward 20 to zero.
3.* Comprehension. What's the thing for you to do:
   (*a*) When you have broken something which belongs to someone else?
   (*b*) When you are on your way to school and notice that you are in danger of being tardy?
   (*c*) If a playmate hits you without meaning to do it?
4.* Similarities. (*a*) Wood and coal; (*b*) apple and peach; (*c*) iron and silver; (*d*) ship and automobile.
5. Definitions superior to use. (*a*) Balloon; (*b*) Tiger; (*c*) Football; (*d*) Soldier.
6.* Vocabulary, 20 words.

Year IX

1.* Date: week, month, day of month, year.
2.* Weights.
3. Makes change. 10 — 4; 15 — 12; 25 — 4.
4.* Repeats 4 digits backwards. 6-5-2-8; 4-9-3-7; 8-6-2-9.
5.* Three words in a sentence. (*a*) Boy, river, ball; (*b*) work, money, men; (*c*) desert, rivers, lakes.
6. Rhymes. Three rhymes for each word. (*a*) day; (*b*) mill; (*c*) spring.

Year X

1.* Vocabulary, 30 words.
2.* Absurdities.
3. Designs.

4. Reading and report.
   New York. | September 5th. | A fire | last night | burned | three houses | near the center | of the city. | It took some time | to put it out. | The loss | was fifty thousand dollars, | and seventeen families | lost their homes. | In saving | a girl | who was asleep | in bed, | a fireman | was burned | on the hands.
5.* Comprehension.
   (*a*) What ought you to say when someone asks your opinion about a person you don't know very well?
   (*b*) What ought you to do before undertaking (beginning) something very important?
   (*c*) Why should we judge a person more by his actions than by his words?
6.* Sixty words in three minutes.

Year XII

1.* Vocabulary, 40 words.
2. Abstract words. (*a*) Pity (*b*) Revenge (*c*) Charity (*d*) Envy (*e*) Justice.
3. Ball and field. (superior plan).
4.* Dissected sentences.
   (*a*) for the started an we country early at hour.
   (*b*) to asked paper my teacher correct I my.
   (*c*) a defends dog good his bravely master.
5.* Fables.
6.* Repeats 5 digits backwards. 3-1-8-7-9; 6-9-4-8-2; 5-2-9-6-1.
7.* Pictures, interpretation.
8.* Gives similarities (*a*) snake, cow, sparrow. (*b*) book, teacher, newspaper. (*c*) wool, cotton, leather. (*d*) knife-blade, penny, piece of wire. (*e*) rose, potato, tree.

Year XIV

1.* Vocabulary, 50 words.
2. Induction test. (Gets rule by 6th folding).
3.* President and king. Difference between.
4.* Problems of fact.
5.* Arithmetical reasoning.
6. Clock. Reverse hands; (*a*) 6:22 (*b*) 8:10 (*c*) 2:46.

Year XVI

1.* Vocabulary, 65 words.
2.* Fables.
3. Difference between abstract words. (*a*) laziness and idleness (*b*) evolution and revolution (*c*) poverty and misery (*d*) character and reputation.
4.* Problem of the enclosed boxes. One large box containing (*a*) 2 smaller, 1 inside of each; (*b*) 2 smaller, 2 inside of each; (*c*) 3 smaller, 3 inside of each; (*d*) 4 smaller, 4 inside of each.
5.* Repeats 6 digits backwards. 4-7-1-9-5-2; 5-8-3-2-9-4; 7-5-2-6-3-8.
6. Code, writes "come quickly."

Year XVIII

1.* Vocabulary, 75 words.
2. Paper cutting test. Draws folds and locates holes.
3.* Repeats 8 digits forwards. 7-2-5-3-4-8-9-6; 4-9-8-5-3-7-6-2; 8-3-7-9-5-4-8-2.
4.* Repeats thought of passage heard.
5.* Repeats 7 digits backwards. 4-1-6-2-5-9-3; 3-8-2-6-4-7-5; 9-4-5-2-8-3-7.
6. Ingenuity test.
   (*a*) A mother sent her boy to the river to get seven pints of water. She gave him a 3 pint vessel and a 5 pint vessel. Show me how the

boy can measure out exactly 7 pints without guessing at the amount. Begin by filling the 5 pint vessel.

(*b*) Same, except 5 and 7 given to get 8. (begin with 5)

(*c*) Same, except 4 and 9 given to get 7. (begin with 4)

The fables used in Ages XII and XVI are entitled (*a*) Hercules and the Wagoner; (*b*) the Milkmaid and her Plans; (*c*) The Fox and the Crow; (*d*) The Farmer and the Stork; (*e*) The Miller, his Son, and the Donkey. A score of two is given for a generalized interpretation, and a score of one for an interpretation that does not go beyond the characters in the fable.

The words used in the Vocabulary Test consist of two series of fifty words each. The idea of the test is to find out whether the child knows the words and not whether the child can define them accurately. A word is considered correct if the subject shows he knows any meaning of the word, however poorly he may define it. The arrangement of the words in the list is from very easy to very hard.

It will be noticed at once from this summary of the Stanford Revision how greatly the scope of the original Binet Scale has been extended and how the whole scheme has been made more consistent and uniform.

The Short Scale. — Because the use of the complete scale takes a fairly long time, and because many occasions arise when it is necessary to get an estimate of a child's intelligence as quickly as possible, Terman has indicated a certain number of tests at each age which may be used as a short scale. The correlation between the short and the long scales is high. In spite of this,

however, the long scale will give the most accurate measure of the individual's mentality and should always be used when possible. The tests to be used in giving the short scale are indicated by an asterisk after the test number.

The Mental Age. — It will be noted that there are six tests at each age from III to X inclusive, and, therefore, the value of each test at these ages is two months. After age X the difference between intelligence from one age to the next becomes gradually less and less, and it becomes harder to find appropriate tests. Terman has, therefore, skipped one year in each case and standardized tests for ages XII, XIV, XVI and XVIII. Furthermore, the number of tests at age XII is eight. Since the tests for age XII cover the ages from X to XII, each test is equivalent to 3 months ($3 \times 8 = 24$ mos.). For the other ages, Terman gives the following equivalents in months: age XIV — 4 months each; age XVI — 5 months each; age XVIII — 6 months each. If the Short Scale is used the tests are of course given higher values, e.g., each test in ages III to X counts 3 months, and so forth.

The method of calculating mental age is the same as suggested by Binet, namely the addition to the basal age of all tests passed above the basal age. The advantage of having 6 tests at each age, each equivalent to two months, is at once apparent in contrast to the old Binet Scale with its five tests necessitating the calculation of tenths of a year. The mental age on the Terman is easily obtained by adding to the basal age the number of months credit obtained by passing tests at higher ages. The result is, therefore, always stated in years and months. It is customary to use the decimal

point between the years and months, e.g., 10.6, meaning thereby 10 years, 6 months, and one must not read this as ten years and six tenths.

Age XVI is called by Terman, Average Adult Intelligence, because it seemed to coincide with the ability of average adults as far as he could estimate at that time. From the results of the mental testing in the U. S. Army during 1917–1919, it would seem that average intelligence is more nearly somewhere between a mental age of 13 and 14 on the Terman Scale. At the present time, therefore, it is well to regard Age XIV as average adult, Age XVI as Superior Adult, and Age XVIII as Very Superior Adult.

The Intelligence Quotient. — The I. Q. is the mental age divided by the chronological. Both ages, chronological and mental, should be stated in terms of years and months in order to get as accurate an I. Q. as possible. If, as is usual, the ages are written with the decimal point between years and months, the examiner must be careful to note that this is not really a decimal point, and, therefore, the two values cannot be divided until they have both been converted into months. For example, Chron. Age = 10.8; M. A. = 8.4.

$$\text{I. Q.} = \frac{\text{M. A.}}{\text{C. A.}} = \frac{8.4}{10.8} = \frac{100 \text{ months}}{128 \text{ months}} = .78$$

This rule for the calculation of the I. Q. holds good for all ages up to the Adult. All adults, regardless of age, will of course be considered as of that chronological age decided upon as equivalent to average adult intelligence. Terman gives as his rule the use of age 16 as the divisor for all adults, i.e., for all subjects who are 16 or over. In view of what has been said above as

to the average age of adult intelligence, the present writer uses and recommends for use age 14 as the divisor for the calculation of the I. Q. for all adults, i.e., for all subjects who are 14 or over. The use of 14 rather than 16 agrees well with more recent considerations as to the upper mental age of feebleminded adults. It is, of course, incorrect to assume any limit of mental age above which no person is to be considered feebleminded, for we must remember that feeblemindedness is a social as well as a psychological concept. If, however, we consider the psychological criterion of feeblemindedness apart from any other criteria, we are rapidly coming to the opinion that no adult of mental age 10 and above is to be considered feebleminded. This being so, and regarding an I. Q. of .70 as the upper limit of feeblemindedness, we note that age 14 is the most suitable age to use in the calculation of the I. Q. of all individuals age 14 and above, because this makes a mental age of about 9.10 the upper limit of feeblemindedness. An adult testing M. A. 10, will have an I. Q. (using age 14) of .71, but if we use 16, the I. Q. will be .63, i.e., definitely feebleminded. Again using 16 as our divisor, and I. Q. below .70 as presumably feebleminded, we shall consider feebleminded all adults who test up to a mental age of 11.1 because M. A. 11.1 divided by age 16 gives an I. Q. of .69. If we use as our divisor age 14, all adults testing between M. A. 10 and M. A. 11.1 will have I. Qs. ranging from .70 to .79 and, therefore, will not be considered feebleminded, as far as the psychological criterion is concerned. From these considerations it is much safer at the present time to consider 14 as the average mental age of adults and use it in the calculation of the I. Q. of all individuals who are chronologically 14 or above.

(*e*) *The Herring Revision.* — The latest revision of the Binet Scale has been constructed by Herring (22). It is an attempt on the part of the author to construct a scale having the same meaning and significance as the Stanford Revision. The correlation between the two scales for 126 children ranging in age from 8 to 13 is .98. Another 154 cases aged 4 to 18 also gave a correlation of .98. To all intents and purposes we would seem to have here an alternative form of the Stanford Revision. As the Herring Scale is made up of similar but different material, it will be of great use in the retesting of children. It will eliminate such practice effect as always results from giving the same scale a second time.

The Herring Scale is a point scale in as much as each test is allotted a number of points. A score in the examination as a whole is the sum of the scores obtained for the separate tests. In order to obviate the necessity for giving all the tests to every subject, the scale is divided up in five groups of tests, Groups A to E. The score made in the first group of tests, Group A, determines the tests which are to be given in the succeeding groups. This circumvents the objection raised against the Yerkes-Bridges Point Scale, with which scale it was necessary to give all of the tests to each subject.

Among the new tests found in the Herring Revision and not found in the Stanford Revision are the following: — Number Series Completion; Size Comparisons; Proverbs; Following Directions; Generalization; News Route. The number of tests in which reading is required is much greater than in the Stanford. The illiterate child or non-English-speaking child would seem-

ingly be even more severely handicapped than on the Stanford.

After the total score has been obtained by adding the scores on all of the tests, the mental age is determined by the tables of norms furnished by the author. The I. Q. is then calculated in the usual manner. The diagnostic significance of the I. Qs. are presumably the same as those obtained by the Stanford Scale.

III. Other Scales

The scales described in this section are not modifications of the Binet and differ radically in the type of test used. Some of them are not age-scales of the Binet type, because they do not have specific tests standardized for specific ages. Some of them also differ from the Binet in the method of calculating the mental age.

(a) *The Pintner-Paterson Performance Scale*

As its name implies this scale (Pintner, 17) is made up of tests calling for a motor rather than a verbal response. The subject is required to do something rather than to say something. All of the tests can be presented without language and no language is required for the response. Hence the scale is admirably adapted for the testing of foreign and deaf subjects as well as the ordinary English-speaking hearing subject. It has proved a valuable supplement to scales of the Binet type.

The scale consists of 15 tests as follows:

1. Mare and Foal Board. This is a picture board of a mare and foal with a number of cut-outs which the

subject has to put in the correct places. It is very simple and resembles a child's game and serves as a very good introduction for children. Time and number of errors are recorded.

2. Seguin Form Board. Ten blocks representing common geometrical forms are to be placed in their appropriate places. The time of the shortest of three trials is recorded.
3. Five Figure Board. Five geometrical figures each divided into two or three pieces are to be placed in their appropriate places. Time and number of errors are recorded.
4. Two Figure Board. Nine pieces to be placed in two spaces. Time and number of moves are recorded.
5. Casuist Board. A more difficult board, consisting of four spaces into which have to be fitted twelve blocks. Time and number of errors are recorded.
6. Triangle Test. Four triangular pieces to be fitted into the board. Time and errors are recorded.
7. Diagonal Test. Five variously shaped pieces are to be fitted into a rectangular frame. Time and errors are recorded.
8. Healy Puzzle A. Five rectangular pieces are to be fitted into a rectangular frame. Time and moves are recorded.
9. Manikin Test. Subject has to put together, legs, arms, head and body to form a man. There is no board into which the pieces fit. Quality of performance is scored.
10. Feature Profile Test. In the same manner as in the previous test, subject has to put together pieces to form a head. Time is recorded.
11. Ship Test. This consists of the picture of a ship cut into ten pieces of the same size and shape which are to be fitted together properly in a rectangular frame. Quality of performance scored.

12. Picture Completion Test. Subject is required to select the appropriate block out of many possible blocks to complete the picture. Quality of performance scored.
13. Substitution Test. A sheet of paper with rows of geometrical figures upon which the subject has to write the proper digit following the key at the top of the page. Time and errors compounded into a score.
14. Adaptation Board. This is a simple test for measuring the ability of the subject to keep his attention upon a moving board. Number of correct moves is recorded.
15. Cube Test. Four cubes are tapped in a certain order and the subject is required to watch and then imitate the movement. Number of combinations correctly imitated is recorded.

Various methods for the calculation of mental age by means of these tests have been suggested by the authors. They show how they may be shaped into a year scale or a point scale. They also show how a mental age may be derived from tables of median performance and also how a percentile rating of the child may be obtained. Those who have made practical use of the scale find the median mental age method of computing mental age the simplest and most accurate. The various times, errors, moves, scores, etc., for the tests are each converted into a mental age by means of the table of norms, and the median of all these mental ages is the mental age of the child. By this method an approximate mental age can be obtained from any number of tests.

The Short Performance Scale. — Ten of the above tests have been chosen by Pintner and Spaid for a short performance scale and they are to be recommended for general testing purposes. The ten tests used are numbers 1, 2, 3, 4, 5, 9, 10, 11, 12, and 15 of the list given above. Tests 9 and 10, the Manikin and Feature Profile, are used as one test because the norms for the former run from age 4 to 8 and for the latter from age 10 to 15. The tests are given and scored as in the long scale and the median mental age is used in the computation of mental age. A further convenience has been introduced by reducing the size of several of the formboards so that all of the tests of the Short Scale can be conveniently carried in a small case. This makes the Performance Scale suitable for the psychologist who has to take his materials with him into the school or hospital.

(b) *The Army Performance Scale*

Like the Pintner-Paterson Performance Scale, this scale (Memoirs 21) is also designed for use without language. It was used in the testing of foreign and illiterate recruits in the army. There are ten tests, the first three of which are taken from the Pintner-Paterson Scale. The tests are: (1) Ship, (2) Manikin and Feature Profile, (3) Knox Cube, (4) Cube Construction, (5) Form Board (Dearborn's), (6) Copying Designs, (7) Digit-Symbol, (8) Maze (Porteus), (9) Picture Arrangement (Fraser and Whipple), (10) Picture Completion (Healy).

The tests are scored by assigning so many points to various types of performance and these scores are then converted into a weighted score for each test. The total

weighted score represents the individual's performance on the whole scale. This total score can be converted into the letter ratings which were used in the army. This scale has not been standardized on children, but equivalent mental ages for various scores have been calculated. A short form of this scale consists of tests 1, 2, 3, 4, 6, 7 and 8.

(c) *The Porteus Maze Scale*

This scale differs from all the others so far described inasmuch as it is composed of a single type of performance for all ages, whereas all other scales include a heterogeneous mixture of tests. The type of test selected by Porteus (15) is the maze, and he has constructed a graded series of mazes, which have been standardized for ages 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, and 14. There is one maze for each of these ages. Year 3 is represented by a diamond, the sides of which are constructed of two parallel lines about $\frac{1}{4}$ inch apart. The subject is required to trace around the diamond between the parallel lines. The next is a cross constructed on the same plan. Harder tests follow the principle of the maze proper, where there are many blind alleys to penalize the subject for lack of forethought. All the tests are carried out by tracing with a pencil on a printed maze. The subject is allowed a specific number of trials on each maze, and his performance is scored either plus or minus. The mental age is computed from the highest test passed, deducting a year for each lower test failed, and a half year for each lower test passed only on the second trial. The scale, therefore, would be classed as an age scale.

The scale is easy to give, can be given in a relatively

short time, and it is decidedly interesting to children. It is also suitable for the testing of non-English-speaking and deaf children, as no language responses are required. The chief limitation, as a general intelligence scale, would seem to be the fact that it is only testing one type of behavior. It is restricted in the range of responses that it calls forth. Nevertheless it is a very valuable supplementary scale.

The author makes a particular plea for the scale on the ground that it is testing " prudent and pre-considered action " — a type of response which, he believes, is lacking in the Binet scale. A measurement of this type of behavior is very desirable, in order to help detect the " conative " type of mental defective who possesses an average amount of " intelligence " as tested by the Binet.

(d) *The De Sanctis Scale*

This short scale appeared in 1906 in the Italian literature (De Sanctis, 06), and in 1911 in the American (De Sanctis, 11). It appeared, therefore, shortly after the first Binet Scale, but its scope is much more limited. The intention of the author was to use it for the classification of feebleminded children into the three grades of idiots, imbeciles and morons, and to differentiate these three groups from children of normal intelligence. It was not his intention to try to measure the various degrees of intelligence of the normal child.

That these tests differentiate between the feebleminded and normal child, is questioned by Martin (16). It all depends, of course, as to our conception of the upper limits of feeblemindedness. Martin made a thorough study and tentative standardization of the De

Sanctis tests and found that "morons as a group are successful to a high degree in passing all the tests (of 53 morons, 36 or 68 per cent passed all)." Martin's most important conclusions are that the tests as arranged by De Sanctis are not quite in order of difficulty, that normal children do better than defectives of the same mental age, that the tests as a series to be used by themselves are too verbal, but that they have high value as tests of mentality and should be valuable as supplementary to the Binet or other scales.

The six tests as arranged by De Sanctis may be briefly indicated as follows:

1. Give me a ball. (5 balls of different colors).
2. Which is the ball you just gave me? (same 5 balls).
3. Do you see this block of wood? (show cube). Pick out all the blocks like this from the pile on the table. (5 cubes, 3 pyramids, 2 parallelopipeds).
4. Do you see this block? (cube). Point out a figure on the form chart that looks like it (show chart). Point out all the squares on the chart as fast as possible (note time, mistakes and omissions — chart has 10 rows — 14 in row — squares, triangles and rectangles).
5. (Spread out blocks on table). How many? Which is largest? Which is farthest away?
6. Do large objects weigh more or less than small objects? Why does a small object sometimes weigh more than a large one? Do distant objects appear larger or smaller or are they really smaller?

De Sanctis' rough method of diagnosis, the accuracy of which Martin questions, is as follows:

(*a*) If second test is failed, mental deficiency is great.

(*b*) If child goes up to fourth test, deficiency is medium.
(*c*) If child succeeds in fifth test, deficiency is slight.
(*d*) If sixth test is passed, there is no defect.

So far the De Sanctis tests have been little used in this country. The more accurately and better standardized Binet and Performance Scales have rendered them somewhat superfluous.

(e) *The Woolley Scale for Adolescents*

This scale has been used only by Woolley (15) herself in connection with her special problem of rating the mentality of adolescents of age 14 and above. In scale form there are standards for only two ages, namely, 14 and 15, and the scale has not been used by other investigators. It is important, however, in being the first scale in which the percentile method of rating was used. It showed the value of this method for arriving at a mental rating of a miscellaneous group of tests, not adapted to the age level type of standardization of the Binet. The standardization is also good for the two ages, because it includes a fair sampling of children both in and out of school, and, therefore, approaches more nearly a normal distribution than is the case with many standardizations which are based entirely upon school children.

The tests used in the Woolley Scale are as follows: Cancellation, Memory for Digits, Substitution, Completion of Sentences, Opposites, Healy and Fernald Construction Puzzles and Problem Box.

(f) *Miscellaneous Scales*

In addition to the five scales we have described in this section under the heading of "Other Scales," there are

several to be found in the literature of mental testing. Most of these, however, are merely slight variations of the Binet or of other scales and the rest are more in the nature of tentative suggestions.

Into this category would fall Knox's (14) Scale for Testing Immigrants, Mullan's (17) Scale of 100 points, also for testing immigrants, Cornell's (17) Graduated Scale, Squire's (12) Graded Mental Tests, Haberman's (16) Intelligence Examination, and the like. None of them have been widely used nor adequately standardized, and it is, therefore, inadvisable to attempt to describe them here.

IV. Special Scales

This section will include a brief mention of scales devised for special types of individuals, who by reason of special defect manifestly cannot be tested by means of the ordinary scales or in accordance with the usual procedure.

(a) *The Blind*

The Columbus Point Scale for the Blind by Haines (16) is a revision and adaptation of the Yerkes-Bridges Point Scale. All tests depending on vision have been eliminated and in their place other tests have been substituted. In addition several new tests have been added. Tests 1, 2, 3, 7, 11, 12 and 16 of the Yerkes-Bridges Scale have been dropped. The following have been added:

Naming objects in a basket by touch.

Size — weight illusion.

Comparison of wooden cylinders, 4 and 6 cm. long.

Adaptation board.

Cube suggestion test.

Chooses nicer feeling, (*a*) Serge and silk, (*b*) velvet and serge, (*c*) velvet and carpet.

Orientation, r. and l.; N. S. E. W.

Finger tapping — Knox-Pintner lines.

Memory for digits (backwards).

The total maximum points is one hundred. Tentative norms for blind children for each age are given. Up to date 160 blind people have been tested, ranging in age from 6 to adult. On the basis of these results Haines gives median scores for each age.

The Binet Test for the Blind revised and arranged by Irwin is a modification of the Goddard Revision and the Stanford Revision. The tests are grouped by ages, from Year III to XII with Years XIV, XVI and XVIII added. Much good work seems to have been done with this scale, although the writer has not been able to discover any published norms at the present time, nor indeed any published description of it. The revision is interesting because it represents largely the work of an educator who is himself blind, and who appreciates fully the value of this kind of work in the education of the blind.

Both of the scales we have just described are very valuable additions to the tools at the disposal of the clinical psychologist, when he is confronted with the special case of a blind child. The use of either of these scales will lead to a much better diagnosis than would be possible with the ordinary scales for seeing subjects. In addition it is to be hoped that the systematic testing of blind children will lead to a better knowledge of the mentality of the blind.

(b) *The Deaf*

The most useful scale and the one that has been most widely used for testing the mentality of deaf children is the Pintner-Paterson Performance Scale, which has already been described. No special norms for the deaf have been published, because the authors believe that the best comparison of the results of a deaf child's performance is with the general standard. Because the tests are equally suited to the deaf as to the hearing, the deaf must be compared with the hearing standards. If, however, we wish to make a diagnosis, we must keep in mind the two or three year difference in mental ability between the deaf and the hearing, and make such allowance as is feasible.

The only other scale that can be legitimately used with deaf children is the Porteus Scale. Porteus himself has used the scale for the testing of the deaf.

In the choice of a suitable scale for testing the mental ability of deaf individuals, we must remember that the problem does not consist merely of eliminating tests that are given orally, or of simply changing auditory stimuli to visual stimuli. The change we are forced to make is much more radical than this. It consists of eliminating entirely all language whether spoken or written. Language is for the deaf something extraneous, something artificial, something that corresponds to a school subject in the case of the hearing child, and the difficulty which the deaf encounter in acquiring language makes all language tests useless for the measurement of their intelligence. The problem of the measurement of the deaf is, therefore, much more complex than is the case with the blind, since all oral language tests are suitable for the blind, for they possess the

same opportunities as the hearing-seeing child for the acquisition of language.

V. Foreign Scales

A few words are appropriate here with reference to intelligence scales which have appeared in foreign countries. So far as the present writer is aware, all the scales for individual testing have been modifications of the Binet, with the exception of the De Sanctis which has been translated and used in America and which we have, therefore, described above.

In England early translations and adaptations were made by Johnston (10), Winch (14–15) and probably by others. The best adaptation and standardization for British use seems, however, to be the recent revision by Burt (21). This version, the author claims, "adheres more closely to the original procedure of the French authors than any of the published revisions." All the tests, however, have been standardized on English children. They are arranged in order of difficulty, as well as being allocated to appropriate age groups. This results in an unequal number of tests at each age. At age VI there are 12 tests while at other ages there are only two or three. The mental age of an individual is determined by the total number of tests passed, and this can be immediately read off from a specially devised chart.

In Germany much work with adaptations of the Binet has been reported by Stern (20), Bobertag, Chotzen and others. Stimulated by the work of Binet, Meumann (13) suggested a rather different type of scale having for each age tests of development, tests of intelligence

and tests of environment. He worked out a tentative scale, but this idea does not seem to have been followed up.

In Italy some work seems to have been done with adaptations of the Binet. The most radical revision of the Binet is that suggested by Saffiotti (16). This revision is called the Trèves-Saffiotti Revision. They abandon the concept of mental age, because the mental picture of a child may change from age to age. The tests are standardized for each age and at each age three grades of intelligence are chosen, e.g., deboli (backward); medi (average); forti (superior). Tests passed by 60 to 80 per cent at any one age are diagnostic of the backward grade; those passed by 40 to 60 per cent are diagnostic of the average grade; and those passed by 20 to 40 per cent are diagnostic of the superior grade. Practically all of the tests of the Binet Scale are in this manner standardized for these three levels of intelligence for four ages, namely, 6, 7, 8 and ages 9–11 inclusive. Obviously this attempt at re-standardization by these Italian psychologists is a reaction against the comparison of the performance of a child of a given age with the performance of children of different ages. This is probably a valid objection as we have noted in the previous chapter, but the Trèves-Saffiotti Revision seems to be too limited in scope and in the number of grades of intelligence to present a feasible way out of the supposed difficulty.

The Binet Scale is said to have been adapted for use in China, Japan, Sweden, Russia, Turkey, and elsewhere. The writer is not familiar with these adaptations and does not know whether any of them have added anything new to our concept or procedure of intelli-

gence testing. Nor is the writer aware of scales, other than those already mentioned, for the individual measurement of intelligence, which have appeared in foreign countries.

Conclusion. — We have attempted in this chapter to give a description of the chief scales for individual examination. These are the chief tools that exist at present for the use of the clinical psychologist for the determination of an individual's mental age. All of the scales described are useful. Some of them are better standardized and more accurate than others. Any of them will add to our knowledge of a particular case. The clinical psychologist should be master of all his tools, and not a slave to any one. His skill and expertness will be manifested by his ability to choose the right tool for any particular job, as well as by the manner in which he uses it.

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CHAPTER VI

GROUP TESTS

Early Attitude. — A group mental test is a test which can be given to a number of subjects at the same time by a single examiner. The group test is to be contrasted with the individual test, which can only be applied to one individual at a time. It is obvious that, if one examiner can handle a number of subjects at one time, there is a great saving of time and labor. Nevertheless, in spite of the obvious economy of time and effort, it is interesting to note that the group test was slow in arriving and in establishing itself as a legitimate method for the measurement of mental ability. The individual scale was well established long before the advent of the group test.

The early attitude of psychologists towards group tests was decidedly hostile. The possible sources of error that might creep in when examining a group were overemphasized. It was assumed to be impossible to obtain a valid intelligence rating by group methods and, therefore, there was considerable delay in making the attempt.

The Beginnings. — Although the group method in intelligence testing was late in making its appearance, we can trace back the beginnings of the use of groups of subjects to the laboratory of the experimental psychologist and to the investigations of the school psychologist

and educator. There was no attempt in these early experiments to arrive at an intelligence rating. Groups rather than individuals were used in order to collect many data in a short time. The investigation of memory was one of the fields in which the group method was extensively used and for which it was well adapted.

As tests for different mental processes were multiplied, the group method of testing became popular. The use of this method was also greatly stimulated by the investigations of the educational psychologist in the school room, and also by the growing interest in the relationship between different mental processes studied by the mathematical formulae for correlation. The large number of tests given by the group method can readily be seen from a study of Whipple's book, *A Manual of Mental and Physical Tests.*

The transition from such single group tests to a series of group tests, the results of which should be combined into an intelligence rating, was obvious and natural. Thorndike was among the first to see the advantages of this method and he must certainly be considered the leader in this movement. In the field of business psychology Scott devised group intelligence tests. Pintner (17) used eight group tests and combined the results for each child into a mental age. This was done in order to get a preliminary intelligence rating for the purpose of deciding which children in a particular group should then be more accurately tested by means of individual tests. The tests used included several single group tests which had been used effectively as single tests by Pyle (13) and which had been well standardized by him. Pyle had always used these as separate tests, and Pintner made the next logical step

inasmuch as he combined the mental ages obtained by any one child on all the tests into a median mental age which was used as a measure of the child's general intelligence.

The Development in The Army. — A great impetus was given to the construction and use of group tests by the advent of mental testing in the army during the World War in 1917–18. We have noted above the beginnings of the group intelligence test, and the development of this method was merely a question of time. The need and value of such a method were recognized, but this method would in all probability have developed slowly, because it would have depended upon the initiative of individual psychologists working more or less in isolation. Their work would have had to overcome a natural amount of inertia and prejudice in the face of the already well-established methods of individual testing, and they would not have been aided by an overwhelming need for the group method. This overwhelming need presented itself in the army situation. Here the problem was to test thousands of men in a short time. Some sort of a group method was obviously an absolute necessity. Again the army situation enlisted the interest and services of hundreds of psychologists. Here, then, instead of individuals working alone, we find a group of psychologists working in coöperation to construct group tests for rating intelligence.

Under these circumstances it was only natural that the group method should within a year reach a degree of development that it, otherwise, would have taken many years to attain. All that was known about group intelligence tests was utilized and further development was rapidly made. The nucleus of the tests ultimately

constructed was the work of Otis and Terman, who, at the time of the introduction of psychological tests into the army, were at work upon a group intelligence test.

So successful were these tests in the army that they overcame the general prejudice against the group test method. The work showed the great value of group tests and suggested innumerable fields in which they could be of use. It was only natural, therefore, that after this a number of group tests should make their appearance. This has been the case. The few years that have elapsed since the signing of the armistice up to the present time have seen the appearance of a great number of group intelligence tests. It will be impossible here to go into a detailed description of all these tests. We shall describe briefly some of the more common types of material used in group tests, and then give a brief description of the tests themselves.

Common Types of Material in Group Tests. — Certain types of material are found in almost all group tests and a description of some of them will be given, because it is impossible to reproduce in this book all the group tests now published. It would not be desirable to do so, even if it were possible.

(A) *Opposites.* — This is one of the oldest and most useful tests. The subject is called upon to respond by writing down or indicating the opposite of a given word, or by deciding whether two words denote opposite or similar ideas.

Underline the word in parenthesis which is the opposite of the first word:

accept. . . . (receive, percept, deny, reject, spend).
constant. . (always, fickle, stationary, seldom, movable).

Underline "opposite," if the two words mean the opposite, and "same" if they mean the same:

furtive ..... sly	same..opposite
any ..... none	same..opposite
asunder ..... apart	same..opposite
deplete ..... exhaust	same..opposite
superfluous ..... essential	same..opposite

(B) *Analogies.* — This test has proved one of the most valuable. The analogy between two words is given and the subject has to decide as to a similar analogy with reference to another pair.

Underline the best of the four words in parenthesis:

cellar....attic: bottom..(well, tub, top, house)
man.....arm: tree.....(shrub, limb, flower, bark)
imitate..copy: invent...(study, Edison, machine, originate)
physics..motion: (?)..blood..(temperature, body, physiology, geography)

(C) *Best Reasons.* — This test appears in many forms. It is often called a test of common sense, or comprehension. The subject indicates in some form or other the best answer to a question.

Check the best reason:

The cause of echoes is
(*a*) the reflection of sound waves
(*b*) the presence of electricity in the air
(*c*) the presence of moisture in the air

Gold is more costly than lead, because
(*a*) it is of finer appearance
(*b*) it is more scarce
(*c*) it is used more for jewelry
(*d*) it is yellow

(D) *Disarranged Sentences.* — This seems to have had its origin in the Binet tests. The words in a sentence are disarranged and the subject has to arrange them properly.

Underline " true " or " false " according to the meaning of the disarranged sentence:

will live bird no forever true..false
always sleeplessness clear causes a conscience
true..false

Cross out the superfluous word in the disarranged sentence:

watch summer the man stole is jail who the in
bushes trees hay roots have and their the ground in.

(E) *Proverbs.* — The subject has to match proverbs of similar meaning, or decide whether they are the same or different in meaning, or match them with statements which explain the meaning.

Proverbs.

1. The burnt child dreads the fire.
2. Rome was not built in a day.
3. There is no smoke without fire.

etc.

Mark the statements which explain these proverbs:

Time is required to produce anything of value.
Failure follows frequent change of plan.
Unhappy experiences teach us to be careful.
Those in disgrace always want to disgrace others.
There is no result without a cause.

(F) *Number Completion.* — This calls for discovering the rule or method in the arrangement of a series of numbers and indicating this in some way.

Write down the two numbers that should come next:

3 4 6 9 13 18 ___ ___

21 18 16 15 12 10 ___ ___

Fill in the missing numbers:

26 22 ___ 14 10 ___ 2

72 ___ ___ ___ ___ 37 ___ ___ ___ ___ 2

Cross out the number that does not belong in the series:

2 4 8 10 16 32

72 36 18 9 6

(G) *Directions.* — This is one of the earliest types of group test. The subject is asked to do just what he is told:

Cross out the "g" in tiger.

Put a dot below this line —.

If Decoration Day comes in winter write the word "No." If not, write the word "Yes."

Write the letter which follows the letter which comes next after C in the alphabet.

(H) *Sentence Completion.* — Words omitted in a sentence or passage have to be filled in.

Write one word on each blank:

The boy ____ two dollars to the Red Cross.

Those things ____ ____ no fear ____ sometimes ____ harmful.

Underline the right word of the three corresponding to the number in the blank:

Once upon a (1) there was a young (2) who was very (3) . He went from (4) to (4) trying to find (5) .

1. time	place	cat
2. bird	man	woman
3. rich	strong	poor
4. place	there	snow
5. him	gold	work

(I) *Information.* — The subject is required to show his general information. Usually the items are spread over a wide field. In so far as the material is based on school knowledge, it is an attempt to get at the intelligence of an individual by measuring what has been learned and retained. This may at times give us wrong measures, particularly if we compare children of very different environments.

Underline the correct word:

Euchre is played with dice, rackets, cards, pins.
The Delco System is used in plumbing, filing, ignition, cataloguing.
Coral is found in trees, reefs, molluscs, mines.
John Wesley was famous in literature, science, war, religion.

(J) *Arithmetical Problems.* — Reasoning problems in arithmetic are offered for solution. This test is frankly educational and does not differ from an achievement test in arithmetical problems.

(K) *Non-Verbal Material.* — Most of this type of material cannot be conveniently reproduced here. Substitution or code tests are very common. All kinds of symbols may be used. The picture completion test calls for the addition of the omitted part. The picture absurdity test requires the subject to indicate what part of the picture is absurd. The maze test requires

the correct marking of the shortest passage. There are many tests which require the subject to copy geometrical forms. The dot imitation test requires the subject to draw lines from one dot to another in accordance with the movements of a pointer. The picture arrangement test demands the rearrangement of the parts of a picture. To become familiar with all this varied non-language material, the reader must study the various tests themselves. No verbal description is adequate.

Description of Group Tests:

1. *Tests Involving Language*

The majority of group tests are of this nature. This type of test is easier to construct and much easier to present than the type of test not involving any language responses, and not requiring the use of language for presentation.

It is obviously impossible in a book of this kind to reproduce all the tests. A short description of the most commonly used and readily available group tests will be given. The description will begin with those useful for the primary grades and will proceed to the more difficult tests suitable for High School and for College.

1. *The Pressey Primer Scale.* — This scale consists of four tests, requiring in all four the same type of response, namely, the crossing out of some superfluous member. In this respect the principal type of response demanded of the child is easily learned and the special directions for each test are much reduced. This is undoubtedly an advantage in the administration of the test. Whether this similarity in response from test to test limits the scope of the examination and, thereby, reduces the differentiating power of the test, is a very natural question. This type of examination may favor

too much one type of ability to the disadvantage of others in the complex known as general intelligence. These are, however, theoretical considerations that can be best solved by empirical investigation.

The first test requires the child to cross out the extra dot in a series of dots; the second test the crossing out of the unlike picture in a series of three pictures; the third test the crossing out of the extra geometrical form; the fourth test the crossing out of the wrong element in a picture. The directions are given to the children orally. The test is well standardized and excellent norms for first and second graders are available.

2. *Dearborn's Intelligence Scale.* Series I. — This is specially adapted to Grades I to III. This scale consists of three examinations, containing the following tests: (1) Following oral directions; (2) Cancellation; (3) Color and form discrimination; (4) Memory for digits; (5) Recognition of objects; (6) Naming pictures; (7) Substitution; (8) Dominoes; (9) Picture completion; (10) Orientation on map; (11) Estimation of distance; (12) Number form puzzles. The tests are long and difficult to give and score.

Norms for half age intervals from age 5 to 10½ are given.

3. *Detroit First Grade Intelligence Test.* — This scale consists of 15 short tests all of which are of the picture type. These tests include following directions, picture completion, drawing geometrical figures, counting, picture-symbol, dot patterns, marking absurd pictures, and others. The tests are easy to give and fairly easy to score. They are suitable for children entering school, and norms for such children are given. The norms are based on over ten thousand children and letter ratings

(A, B, C +, C, C −, D, E,) are used. No norms for age groups have so far appeared.

4. *Kingsbury Primary Group Scale.* — This scale is devised for grades 1, 2, 3, and 4. It consists of four tests: (1) Right answers to little stories; (2) Opposites in pictures; (3) Completion series; (4) Form test or Block Building. All the tests are picture tests.

The tests have been given to children in the first four grades and norms for these children are available.

5. *Pintner-Cunningham Primary Tests.* — The tests consist of: (1) Common observations; (2) Esthetic judgment; (3) Associated objects; (4) Discrimination of size; (5) Picture parts; (6) Picture completion; (7) Dot drawing. No knowledge of letters and numbers is required. They are suitable for kindergarten, first and second grades. Age and grade norms are available.

6. *Cole and Vincent Test for School Entrance.* — This examination consists of 8 tests: (1) Marking things which go fastest; (2) Recognition of forms; (3) Visual memory; (4) Differences of letters; (5) Information; (6) Drawing; (7) Mazes; (8) Tapping. Equivalent Stanford mental ages for scores on this test are published.

7. *Otis Primary Examination.* — Consists of 8 tests: (1) Following directions; (2) Association; (3) Picture Completion; (4) Maze; (5) Picture sequence; (6) Similarities; (7) Synonym — antonym; (8) Common sense.

8. *Gunnison Primary Test.* — This consists of four parts. Parts I and III are fore-exercises similar in nature to Parts II and IV, which constitute the test proper. The tests are: (1) Oral directions; (2) Picture completion; (3) Logical relation; (4) Story arrangement; (5) Arithmetical reasoning; (6) Memory; (7) Learning; (8) Classification.

9. *The Haggerty Delta 1.* — This test is designed for grades 1 to 3. It was devised for and used in the Virginia School Survey. It consists of 12 exercises, six of which are fore-exercises for the purpose of practice, and the other six are the tests proper. Each of the tests is, therefore, preceded by a fore-exercise in the same kind of performance as the test which follows. According to Haggerty, " The fore-exercise is intended to serve two purposes: (1) to afford opportunity for giving preliminary instruction in the method of performing the real test, and (2) to give all pupils some practice in the test in order to equalize the preliminary experiences of the children with the test."

The six tests of the series may be briefly described as follows: (1) Following oral directions; (2) Copying designs; (3) Picture completion; (4) Picture comparison, i.e., deciding whether two pictures are the same or different; (5) Symbol-digit; (6) Word comparison. The first four tests deal with pictures alone. The fifth test introduces numbers, and the sixth, words. These two tests would, therefore, make the whole scale unsuitable for the classification of children entering school for the first time.

10. *The Haggerty Delta 2.* — This test is designed for grades 3 to 9. It is an adaptation of the Army Intelligence Examinations and was devised for and used in the Virginia School Survey. There are six exercises as follows: (1) Discrimination between true and false statements; (2) Arithmetic; (3) Picture completion; (4) Discrimination between words, whether same or opposite; (5) Common sense judgments; (6) General information.

Most of the useful devices used in the Army Tests for

ease in scoring, etc., are found in this test. It is better than the Army Test for school purposes. The norms consist of the average score for each age for ages 8 to 15, and each grade for grades 3 to 9. These average scores are probably very reliable as they are based on 20,000 cases.

11. *The Myers Mental Measure.* — This group examination consists of three exercises. The whole booklet consists entirely of pictures so that no verbal responses are demanded. The directions for doing the tests are oral and, therefore, a knowledge of the English language is necessary for the examinee. The author claims that the test is suitable for first graders and that it differentiates from age 6 up to adult. Test 1 is a test of following directions; test 2, a picture completion test; test 3, a recognition of similarities.

12. *Dearborn Intelligence Scale.* Series II. — This is specially adapted to grades 4 to 9. It consists of two examinations, containing the following tests: (1) Picture sequences; (2) Word sequences; (3) Form completion; (4) Opposite completion; (5) Faulty pictures; (6) Disarranged proverbs; (7) Number problems. Norms for ages 6 to 20, and for grades 2 to 12 are given.

13. *The Pressey Cross-out Tests.* — This group test is useful for grades 3 to High School. There are four exercises, each calling for the same type of response, namely, crossing out something. Test 1, cross out the superfluous word in disarranged sentences; Test 2, cross out the superfluous word in lists of words related to each other; Test 3, cross out the superfluous number in a number series; Test 4, a moral judgment test in which the worst thing in the list is to be crossed out. It will

be noted that the last test differs radically from the type of test usually included in intelligence examinations. It calls for moral judgments and assumes that a high degree of conformity in these with the conventional standards goes along with high general intelligence. This is probably true, and yet the test seems a little out of place in a general intelligence examination. It foreshadows morality and character tests.

There are excellent norms for these tests for ages 10 to 17, and for grades 3 to 12.

14. *The Pintner Survey Tests.* — These tests are suitable for Grades 3 to High School. They consist of six tests which have been mentioned above in connection with the early beginnings of group testing. The norms are based upon about 3500 cases and extend from age 6 to adult. They are among the few group tests for which percentiles for each age have been adequately calculated.

15. *The National Intelligence Tests.* — These tests were prepared under the auspices of the National Research Council by Haggerty, Terman, Thorndike, Whipple and Yerkes. There are several different forms available. Two booklets are to be used for each examination. Each test booklet contains five exercises. Scale A contains: (1) Arithmetic; (2) Sentence completion; (3) Checking attributes possessed by a given word; (4) Discrimination of similarity and difference as applied to words; (5) Symbol-digit tests. Scale B contains: (1) Arithmetic; (2) General Information; (3) Logical Judgment; (4) Analogies; (5) Discrimination of similarity and difference as applied to numbers, names and forms.

The novel feature of this test is the fore-exercise that

precedes each exercise proper. This fore-exercise is a sample of the performance to be carried out by the examinee and gives him an opportunity of some practice before beginning the test proper. In most cases the length of the fore-exercise is a little less than half of the test proper. In no other test has this theory of the necessity for preliminary practice been carried to such an extent. It conflicts somewhat with the theoretical definition of general intelligence as being a measure of ability to adapt. Quickness and readiness of adaptation become more difficult to measure the greater the amount of previous practice. This is theoretical merely and it may be that tests with an appreciable degree of fore-exercise will nevertheless prove of higher value than those having little or no fore-exercise. In this case the above interpretation of the definition of general intelligence will have to be revised.

There are age and grade norms available, based on many cases.

16. *Whipple's Group Test for Grammar Grades.* — This test is suitable for grades 4 to 8. It is the result of extensive work done by the author in the study of tests suitable for differentiating superior children. It consists of six exercises: (1) Arithmetic; (2) Sentence Completion; (3) Checking true and false statements; (4) Checking attributes possessed by a given word; (5) Punched Holes Test; (6) Matching Proverbs.

This test, like the National Intelligence Test, also provides a fore-exercise before each exercise proper, but the length of the fore-exercise is considerably shorter than in the previous case. Tentative norms are given for Grade 7.

17. *Chicago Group Intelligence Test.* — This scale is

adapted for the grammar grades and for High School. It consists of five tests: (1) Opposites; (2) Missing Steps in Number Series; (3) Same or opposite Proverbs; (4) Analogies; (5) Selecting Best Reasons. All the tests are verbal, and two different forms are available. Grade norms have been published.

18. *The Otis Group Intelligence Scale.* — This group test is suitable for grades 5 to 12 and for the four years of High School. It is also difficult enough for College Students. It consists of ten parts, as follows: (1) Following printed directions; (2) Opposites; (3) Disarranged Sentences; (4) Matching Proverbs; (5) Arithmetic; (6) Geometric Figures; (7) Analogies; (8) Similarities; (9) Narrative completion; (10) Memory.

19. *Chapman and Welles High School Test.* — This is designed for the Junior and Senior years of High School. The test consists of three exercises, similar to those in the Army Tests, e.g., (1) Opposites; (2) Arithmetic Problems; (3) Information.

This is one of the shortest group tests available and is useful in emergencies where speed in testing and scoring is necessary. The total working time on the test is 9 minutes, exclusive of time spent in explanation. We must, of course, remember that our results will decrease in reliability as we shorten the working time.

Tentative norms for the Junior and Senior High School years have been published.

20. *Thurstone's Psychological Examination.* — This is described as suitable for High School Seniors and College Freshmen, but it can be used effectively for all years in High School or College. It consists of a great number of problems involving analogies, number com-

pletion, logical reasoning, mental arithmetic, general information, sentence completion, proverb matching and the like. Unlike the usual group test, the items are not grouped together in various tests, but are thoroughly mixed up in a spiral arrangement, the same type of problem occurring again and again, beginning with the easiest examples and gradually becoming harder and harder. The subject is given a specific time for the whole examination.

21. *Trabue Mentimeters.* — These consist of a group of thirty tests gathered from various sources, including many adaptations of well-known tests as well as some original ones. In addition to intelligence tests proper, they include educational tests as well as tests for specific abilities. The whole group of thirty tests is not supposed to be given to the same individual, but the psychologist is expected to choose a series of tests suitable for each specific need. The authors indicate certain groups for certain purposes. For the classification of clerical workers in business and industry, the following tests are recommended: Nos. 6, 7, 8, 9, 16, 23, 24, 28; for testing the intelligence of laborers: Nos. 2, 3, 5, 6, 9, 18, 28, 29; for testing the intelligence of public school children: Nos. 2, 3, 8, 16, 20, 23, 28, 29; for testing educational attainment; Nos. 10, 17, 19, 21, 25, 26, 27, 28; for social entertainment: Nos. 2, 3, 5, 6, 18, 20, 22, 23, 24, 27, 29, 30.

The thirty tests are as follows: (1) Typical Performances of Young Children. These are the Binet tests for infants and young children. (2) Pictorial Absurdities; (3) Maze; (4) Dot Patterns; (5) Geometrical Figures; (6) Completion Series (Forms); (7) Checking Identity of Numbers; (8) Digit-Symbol Sub-

stitution; (9) Completion Series (Numbers); (10) Addition Tests; (11) Memory for Numbers; (12) Repeating Numbers Backward; (13) Memory for Sentences; (14) Vocabulary Test; (15) Word Discrimination; (16) Naming Opposites; (17) Spelling Test; (18) Range of Information; (19) Reading Vocabulary; (20) Directions Test; (21) Reading; (22) Disarranged Sentences; (23) Sentence Completion; (24) Analogies; (25) Handwriting; (26) Composition; (27) Poetic Discrimination; (28) Arithmetical Problems; (29) Practical Judgment; (30) Logical Conclusions.

For the eight tests designed for school use and called School group 2A, there are norms for all grades from Kindergarten to University. Obviously the Kindergarten and lower grade children are able to score on only a few of the tests.

22. *Terman Group Test of Mental Ability.* — This consists of ten tests as follows: (1) Information; (2) Best answer; (3) Word meaning; (4) Logical selection; (5) Arithmetical problems; (6) Sentence meaning; (7) Analogies; (8) Mixed sentences; (9) Classification; (10) Number Series. Suitable for grades 7 to 12. Age and grade norms are available.

23. *Miller Mental Ability Test.* — Consists of three tests: (1) Disarranged sentences combined with directions; (2) Controlled association; (3) Analogies. This is a short test and seems to work very well. It is suitable for grades 7 to 12.

24. *Otis Group Intelligence — Higher Examination.* — This contains most of the stock material, arranged, like Thurstone's test, in the cycle form. It is called " self-administering " in the sense that there is a time limit for the whole examination and, therefore, there is

no need for an examiner to time each part of the examination. It is useful for all classes in high school and college.

25. *The Army Alpha.* — This test is suitable for adults and was used in the army. It has been effectively used in High School and to some extent in the Elementary School. It proved particularly valuable in the army, but it is not, therefore, the best for use in colleges or schools. Much of the content is so constructed as to appeal to soldiers. There are eight tests as follows: (1) Following directions; (2) Arithmetical problems; (3) Practical judgment; (4) Synonym-antonym; (5) Disarranged sentences; (6) Number series; (7) Analogies; (8) Information. The army tests are reproduced in the Memoirs of the National Academy of Sciences (21) and in a book by Yoakum and Yerkes (20).

There are five different forms of the Army Alpha, all roughly of the same degree of difficulty. It is, therefore, extremely useful in testing groups where there is danger of coaching. As this test was given to more than one million unselected recruits, there are very reliable norms for adults. No other group test has so far been given to such a random sampling of American adults, and the standards for this test represent, therefore, the most reliable measures of the intelligence of American adults. In addition, equivalent scores for the Alpha and Stanford-Binet have been computed, so that we may obtain an approximate mental age from the scores on the Army Alpha.

26. *Thorndike Intelligence Examination.* — This is a team of five tests devised by Thorndike and represents the most extensive and thorough intelligence examination that has so far been devised. It requires 2 hours

and 40 minutes of working time, and is also relatively difficult to score. Many of the tests require thorough knowledge of the material and sound judgment in order to achieve uniform and accurate scoring.

The first three test blanks are modified forms of the Thorndike Mental Alertness Tests for Aviators. The degree of difficulty of these three blanks is greater than that of the Army Alpha. The first blank is given to the subject for purposes of inspection in order to familiarize him with the nature of the tests. After this he works on blanks two and three. Blank four involves the understanding of difficult reading, completion of sentences, drawing completion, general information, etc. The fifth blank tests the ability to read and understand difficult prose.

The tests are decidedly difficult and are suitable for seniors in high school and college students. Several forms of the examination have been compiled. These tests are used for the examination of Columbia Freshmen.

27. *Roback Mentality Tests.* — There are twelve tests: (1) Abstraction; (2) Problems; (3) Analogies; (4) Relations; (5) Insertion; (6) Reference; (7) Opposites; (8) Acumen; (9) Subsumption; (10) Interpretation; (11) Judgment; (12) Cryptogram. They are distinctly difficult and are suitable for college students. They are difficult to score, much depending on the subjective judgment of the scorer.

II. Tests not Involving Language

Group tests which use language in giving the necessary directions or in the actual working of the test problems are, of course, much easier to devise than those which

can be given and taken without the use of the English language. Non-language group tests are, however, of great value and in some cases absolutely necessary. This is particularly true in the United States with its large non-English-speaking population. Such tests are, moreover, valuable supplements to the ordinary language group tests. Intelligence in dealing with things and people may be more accurately measured by non-language than by purely language tests.

The need for such tests in addition to the usual verbal tests is very great. With reference to this Thorndike (19) says, " In later work where intellect operating with things and with people came into due consideration, it became clear that the use of ' intellect ' and ' intelligence ' to refer rather exclusively to the ability to work with ideas and symbols is very dangerous unless one understands the limitations and provisos that should accompany such use. Its use to refer rather exclusively to the ability to work with ideas *expressed in words* is still more dangerous."

(1) *Army Beta.* — This consists of seven tests, all of which are explained in gesture by the examiner and demonstrated on a blackboard chart by the demonstrator. The procedure is acted out before the group.

The tests are: (1) Maze Drawing; (2) Cube Analysis; i.e., counting the number of cubes in drawings of various arrangements of cubes; (3) X-O Series or completing series of crosses and circles arranged in various rhythmic sequences; (4) Digit-Symbol; (5) Number Checking; (6) Drawing Completion; (7) Geometrical Construction, i.e., drawing the divisions in a square to correspond to the separate scattered pieces.

The Beta test was given to thousands of non-English-

speaking recruits in the army and proved a valuable means of measuring their intelligence, an end which could never have been attained by means of the usual language group test.

(2) *Pintner Non-language.* — This test has been devised and standardized for use with school children. Each test is demonstrated on the blackboard and no language is necessary for the understanding of the directions or for doing the exercises of the test. The test blank consists of the following six exercises: (1) Movement Imitation, i.e., reproducing the movements of a pointer after it has been moved from dot to dot in different ways on the blackboard. This is essentially the Knox Cube Test arranged for group purposes. (2) Easy Learning, i.e., a very simple digit-symbol test containing three elements. (3) Hard Learning, i.e., a more difficult digit-symbol test containing nine elements. (4) Drawing Completion, i.e., drawing in the missing parts of pictures. (5) Reversed Drawings, i.e., reproducing geometrical forms as they would be when turned upside-down. (6) Picture Reconstruction, i.e., indicating by numbers the positions of the parts of pictures so as to make a complete picture.

The test takes about 30 minutes to give and has proved very serviceable, requiring, as it does, simply a blackboard and one demonstration picture. It has been well standardized on ordinary school children, and these norms form a good basis for comparison with other groups, e.g., foreign-born, deaf and the like. Its use with over two thousand unselected deaf pupils makes it the best standarized mental test for the deaf.

(3) *Thorndike Non-language.* — This is another test that can be given without language. The author feels

that language tests ought to be supplemented by others of the non-language type. To quote from his article (Thorndike, 19): "The first forms of group examinations of intelligence consisted chiefly of intellectual tasks with words and numbers and presupposed a considerable ability to read. They were thus unavailable for use with foreigners and illiterates, were unfair to those of limited opportunity to learn to read well, and in all cases measured intelligence with words and numbers to the relative exclusion of intelligence in dealing with things and people."

The test consists of the following exercises: A test in substituting arbitrary symbols for digits; a test in drawing lines so as to divide a surface into the parts shown beside it; a test in completing pictures of common objects; a test in completing a rhythmic series of forms; an analogies test with pictures; a mixed spatial relations test; a test of memory of objects; and a test in easy computation.

The test has been successfully given to feebleminded individuals, several groups of school children and to officers and men in the army, and has been found to have great discriminating power.

III. Combined Mental-Educational Tests

It is not the purpose of this book to enter into a discussion or even enumeration of the great number of educational tests that have been devised for the purpose of measuring school attainment. Only indirectly are they to be considered mental tests. Their chief function is to measure achievement in the conventional subjects studied in school. These two fields of measurement, mental and educational, have grown up and ex-

panded together, the one seeking a more exact measure of the innate mental abilities of the individual and the other a measure of the modification of these abilities along the specific lines of school studies. The value of a combined use of these two types of measurement is at once obvious. Such a combination will lead to an evaluation of school achievement in terms of mental ability. It will help us to determine what amount of educational attainment we can expect from a pupil of a given mentality. If a child has so much innate ability, we can expect a certain degree of educational attainment in the ordinary school environment. Furthermore, such a combined use of mental and educational tests will permit us to evaluate more justly the work of the teacher and to rate more accurately the work of the school or school system.

In most educational surveys up to the present time it has been tacitly assumed that the mentality of the pupil-material is constant, and schools and school systems have been compared solely on the basis of the results obtained by means of educational tests, whereas we now know that there are great differences in the mental ability of pupil-material in different schools and in different school systems. The fact that school A rates lower than school B in arithmetic, or reading or any other school subject, cannot in itself be taken as indicative of poorer teaching or administration. Before any such judgment can be made, we need to have a mental rating of the schools. And when we have such a rating, it will often be found that the school with the lower educational score is really doing better work than its competitor, when we take into consideration the mental caliber of the pupil-material.

Most important of all, a proper use of combined mental-educational tests will enable us to prevent the enormous waste of intelligence that prevails in our schools today. By finding out how much we may fairly expect of children of different degrees of intelligence, we can insist more readily on each one working up to his capacity. This will diminish the useless pressure brought to bear upon the inherently dull child, and will give the brighter child more chance to expand and utilize his powers. By doing this, we shall make the task easier and pleasanter for both the teacher and the child. The over-worked children in our schools today are those of lower mentality, for the system is trying to make them keep step with the average child. The laziest and most neglected are the brighter children who are kept back in order to keep pace with the average child. The more accurately we can evaluate school attainment in terms of mental ability, the more evenly can we distribute the load that each child may be expected to bear.

(1) *The Pintner Mental-Educational Tests.* — These tests consist of two booklets: (1) The Non-Language Mental Tests described above for the measurement of mental ability; (2) a survey test covering the chief elementary school subjects, e.g., reading, arithmetic, grammar, history, geography. They are best adapted to grades 3 to 8 inclusive, although they may be helpful in High School. The method of evaluation consists in converting by means of standard tables the pupil's score on each test into a mental and an educational index. These two indices are directly comparable and the difference between the two shows whether the child is working up to his mental capacity or not. In this way,

we have an extremely effective method of indicating those children who can be expected to do better school work commensurate with their mental ability. When such cases are pointed out to the teacher and superintendent, effective measures can be undertaken to correct this discrepancy between achievement and ability. The tests are well standardized and have proved very useful in several school surveys.

(2) *The Illinois Examination.* — This is a combined mental educational measure with all the tests printed in one booklet. Part I is for Grades 3, 4, and 5. Part II is for Grades 6, 7, and 8. It consists of: (1) The Intelligence tests, comprising tests of analogies, arithmetical problems, sentence vocabulary, substitution, verbal ingenuity, arithmetical ingenuity, and synonym-antonym. (2) The educational tests of reading and arithmetic.

The difference between the mental and educational tests is not so sharply drawn as in the Pintner Tests, because the mental tests include arithmetic and arithmetical ingenuity. All the other mental tests are language tests. The educational tests comprise only two of the school subjects, namely, reading and arithmetic.

The scores on the mental tests are converted into mental ages and intelligence quotients. This conversion is greaty facilitated by means of a table. The scores on the educational test are converted into achievement ages and achievement quotients. Separate achievement ages and quotients are given for Rate of Reading, Comprehension of Reading, and Arithmetic.

TABLE I. — AGE NORMS FOR GROUP TESTS *

Test	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	Adult
Army Alpha					2	7	16	27	40	56	71	85	102	125	147			
Army Beta				2	11	24	37	47	58	67	75	81	88	95	104			
Dearborn I		15	47	84	112	135	150	162	174									
Dearborn I. A		12	28	47	63	73	81	87	92	96								
Dearborn II			2	14	25	37	49	61	73	85	97	109	121	133	145	157	169	
Haggerty Delta I				35	50	67	75											
Haggerty Delta II					25	43	55	66	77	87	100	115						
Illinois		0	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	
Kingsbury			22	34	46	56												
Myers			9	16	23	28	34	39	43	47	49	49	50					
National A					38	58	75	90	101	112	123							
National B					36	56	73	88	99	110	121							
Otis Primary			20	30	40	50	60	70	80									
Otis Intelligence					46	58	70	82	94	106	117	124	127	129	130			
Otis Higher									26	30	34	37	40	41	42			
Pintner-Cunningham	11	17	26	35	44													
Pintner Non-Language			46	103	163	210	248	292	343	370	389	436						494
Pressey Primary		22	35	47	55	60												
Pressey Cross-Out							40	46	52	58	65	70	77	81				
Terman Group							18	40	60	81	103	125	146	167	188	210		
Thorndike Non-Verbal						45	65	85										
Trabue Mentimeter				15	32	45	57	67	75	82	88	93	96					

* These norms are for the most part obtained for the age last birthday. They are, therefore, norms for $4\frac{1}{2}$, $5\frac{1}{2}$, $6\frac{1}{2}$ and so forth.

TABLE II. — GRADE NORMS FOR GROUP TESTS

Test	Grades									High School				College
	K	1	2	3	4	5	6	7	8	I	II	III	IV	
Chapman and Welles								60		111				
Chicago Group								35	38	43	48	53	58	
Dearborn II			14	26	36	51	62	76	90	106	116	126	130	
Detroit		27												
Haggerty Delta I		35	55	70										
Haggerty Delta II				40	60	78	96	110	120	130				
Illinois				23	38	53	64	76	87					
Kingsbury		21	34	47	58									
Miller								35	46	53	62	69	74	
Myers		12	19	26	33	38	44	49	53					
National A				43	66	87	104	121	132					
National B				37	64	83	100	115	129					
Pintner-Cunningham	17	28	41											
Pressey Primary		34	52											
Pressey Cross-Out				25	36	44	51	57	65	74	78	82	84	
Terman Group								67	87	105	122	134	148	
Thurstone														85
Trabue Mentimeter	10	25	38	50	60	70	80	90	99	108	116	123	128	135
Whipple Group								98						

Standard Scores

For most of the group tests that have been described, fairly reliable age norms exist. These norms are generally median or average scores for the ages in question. Grade norms for group intelligence tests are not so common. In Tables I and II are given all age and grade norms which could be found for the tests mentioned in this chapter.

Conclusion. — This brief description of group tests must necessarily be very unsatisfactory. To convey to those unfamiliar with group intelligence tests any adequate notion of their make-up and scope, it would be necessary to reproduce dozens of the test forms, and this would be an impossibility in this book. The reader is, therefore, urged to make himself familiar with the different blanks. Many of the tests have been reproduced in psychological journals and sample copies of all of them can be bought from the various publishers.

List of Group Intelligence Tests

Arranged alphabetically, for the most part, according to the author's name with name of publisher.

Chapman and Welles High School, Dobson-Evans Co., Columbus, O.

Chicago Group Intelligence, University of Chicago.

Cole-Vincent Primary, Kansas State Normal, Emporia, Kan.

Dearborn I and II, Lippincott, Philadelphia, Pa.

Detroit Primary, World Book Co., Yonkers, N. Y.

Gunnison Primary, Colorado Normal, Gunnison, Col.

Haggerty, Delta 1 and 2, World Book Co., Yonkers, N. Y.

Illinois Examination I and II, Public School Pub. Co., Bloomington, Ill.

Kingsbury Primary, Public School Pub. Co., Bloomington, Ill.
Miller Mental Ability, World Book Co., Yonkers, N. Y.
Myers Mental Measure, Newson & Co., N. Y.
National, World Book Co., Yonkers, N. Y.
Otis Primary, World Book Co., Yonkers, N. Y.
Otis Intelligence, World Book Co., Yonkers, N. Y.
Otis Higher, World Book Co., Yonkers, N. Y.
Pintner-Cunningham Primary, World Book Co., Yonkers, N. Y.
Pintner Non-Language, College Book Store, Columbus, O.
Pintner Survey, Stoelting Co., Chicago, Ill.
Pressey Primary, Public School Pub. Co., Bloomington, Ill.
Pressey Cross-Out, University of Indiana.
Roback Mentality, Stoelting Co., Chicago, Ill.
Terman Group, World Book Co., Yonkers, N. Y.
Thorndike Intelligence, Teachers College, Columbia.
Thorndike Non-Language, Teachers College, Columbia.
Thurstone Psychological, Stoelting Co., Chicago, Ill.
Trabue Mentimeter, Doubleday, Page & Co., N. Y.
Whipple Group, Stoelting Co., Chicago, Ill.

List of Group Intelligence Tests arranged according to Grades for which they are more or less suitable.

Kindergarten — Pintner-Cunningham, Kingsbury, Cole-Vincent, Myers, Trabue.

Lower Primary Grades — Pressey Primary, Dearborn I, Haggerty Delta I, Detroit, Kingsbury, Pintner-Cunningham, Cole-Vincent, Otis Primary, Gunnison, Myers, Trabue.

Grammar Grades — Myers, Haggerty Delta 2, Dearborn II, Pressey Cross-Out, Pintner Survey, National, Whipple, Otis Group, Chicago, Trabue, Pintner Non-Language, Thorndike Non-Language, Illinois.

High School — Myers, Otis Group, Chicago, Chapman and

Welles, Thurstone, Army Alpha, Trabue, Terman, Miller, Otis Higher, Thorndike Non-Language.

College — Myers, Thurstone, Army Alpha, Trabue, Otis Higher, Thorndike College, Roback.

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Pintner, R. and Marshall, H. (21) A Combined Mental-Educational Survey. J. of Ed. Psych., Vol. XII. pp. 32–43; 82–91.

Pressey, L. W. (20) A Group Scale of Intelligence for Use in the First Three Grades. J. of Ed. Research, Vol. I, April. pp. 285–294.

Pressey, S. L. and Pressey L. W. (19) Cross-Out Tests. J. of Applied Psych., Vol. III. pp. 138–150.

Pyle, W. H. (13) The Examination of School Children. Macmillan, N. Y.

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Thurstone, L. L. (19) Mental Tests for College Entrance. J. of Ed. Psych., Vol. X. pp. 129–142.
Trabue, M. R. and Stockbridge, F. P. (20) Measure Your Mind. Doubleday, Page, N. Y.
Whipple, G. M. (21) The National Intelligence Tests. J. of Ed. Research, Vol. IV. pp. 16–31.
Yoakum, C. S. and Yerkes, R. M. (20) Army Mental Tests. Holt, N. Y.

PART III
THE RESULTS

CHAPTER VII

THE APPLICATION OF INTELLIGENCE TESTS

We have sketched in Part I the early development of mental tests. In Part II we have surveyed the most important mental tests, both individual and group, which lie at the disposal of the psychologist. In Part III we shall now attempt to describe the various fields in which mental tests have been successfully used and in doing so we shall try to sum up the chief results in each field. The number of investigations in each field has, however, been so large, that it would be impossible and unwise to undertake to describe them all. Indeed, it would be unprofitable even to list them all. Only a few of the more important investigations can be described in order to bring out the main contributions that intelligence testing has made to the understanding of the different groups of individuals studied.

The beginnings of the intelligence testing movement were closely bound up with the study of mental deficiency and abnormality. It was, therefore, quite natural that much of the earliest work had to do with the selection of mentally deficient children. For a long time this phase of intelligence testing was predominant, and we have a number of studies dealing with the mental examination of feebleminded children and the examination of other children for the purpose of selecting out the feebleminded.

Closely connected with feeblemindedness is the problem of juvenile delinquency, and it was natural that the juvenile delinquent should very soon attract the attention of the psychologist. In this way intelligence testing spread rapidly from the feebleminded to the juvenile delinquent and in due time to the adult delinquent. All this work raised the pertinent question as to the relation between intelligence and crime.

It was inevitable that the study of the delinquent child should lead on quite imperceptibly to the study of the dependent child, because of the close proximity of these two types of children in our juvenile courts. We, therefore, see the psychologist comparing the mentality of delinquents and dependents and later on studying the mentality of the dependent alone, as he is found in our children's homes, orphans' homes and the like.

The mere selection of the feebleminded in the school could not very long hold the interest of the psychologist. It was natural that his interest should broaden and expand into a study of the mentality of children in general. And in this broadening process the next striking phenomenon was the appearance of the very bright or superior child. School teachers and educators have, of course, always realized that some children were brighter than others, but it remained for the psychologist to be able to state definitely just how much brighter. It is doubtful whether the very decided superiority of some children was really appreciated before the advent of the psychological examination.

We now see the psychologist fairly well embarked on a study of the mentality of children in general, and a beginning made in the classification of school children into all degrees of intelligence by means of the individ-

ual scales then at his disposal. He was, however, handicapped in this work by the slowness of the procedure, the individual test taking from half an hour to an hour for each child, and the testing of whole schools requiring a corps of testers. This was rarely feasible and mental examinations would have been restricted to small groups of children for special purposes, had it not been for the coming of the group test. With the appearance of this method of intelligence examination, it became possible to test large numbers of school children. This brought in the period of school surveys on a large scale with their direct and important influence on the classification of children according to intelligence for the purpose of instruction. At the same time the group method was extended to other groups of individuals, soldiers in the army, prisoners, college students and the like.

While the general development of intelligence tests was taking place, we note also the extension of the use of tests to special groups of individuals. Notably among these groups are the blind and the deaf. The intelligence testing of the blind and the deaf by the group as well as by the individual method has led to an increased knowledge and understanding of the specific problems encountered in the education of these children.

During all this development the use of intelligence tests in the study of racial differences has been going on. The most thorough-going studies have been made on the negro in America. Other races have only been studied slightly. The possibilities in this line of work are very great, although there are certain inherent difficulties that have not yet been fully overcome.

The field of industry and commerce is one of the latest fields in which intelligence tests have been adopted

Their value in the selection of employees and in the classification of workers with a view to assignment and promotion has now been fully recognized and they are proving an important adjunct in the solution of the problems confronting the employment manager and the business executive. In the larger sphere of vocational selection and guidance mental tests are beginning to find their place.

Lastly, in the problem of inheritance, intelligence tests are beginning to contribute something of importance. Although little has been done in this field at the present time, it seems probable that much will be done in the future, and that intelligence tests will throw some light upon the important question of the inheritance of intellectual capacities.

The remaining chapters of the book will be devoted to the various fields of investigation which have been outlined in brief in this chapter.

CHAPTER VIII

THE FEEBLEMINDED

The study of the feebleminded as a special group dates back to long before the advent of the psychological test, and there are, of course, many phases of the problem of the feebleminded that are not psychological and have little or no interest to the psychologist as such. It is, nevertheless, true that during recent times psychology has made important contributions to our understanding of these children, and the application of intelligence tests has decidedly changed and modified our ideas with respect to them.

It used to be thought that the feebleminded were a very small and very distinct group of individuals, forming more or less a distinct species and differentiated from the normal by a very marked divergence in their intellectual and emotional life. They were considered as beings apart, radically different from the rest of humanity. By some authorities they were thought to be closely allied to the insane and, indeed, a clear distinction between the insane and the feebleminded is not yet universal in the medical profession. Although the cause of feeblemindedness was unknown, it was more or less treated as an incurable disease, and the feebleminded were considered the special care of the physician. At times there arose a belief in the possibility of cure, either through the agency of the physician or the edu-

cator. The importance of education was first emphasized by Seguin in France and later on in the United States. Seguin's belief in the possibilities of improvement by means of his physiological method was very great and amounted at times almost to a belief in the possibility of cure. His enthusiasm and aggressiveness resulted in untold good in the care of these children, and his emphasis upon education modified for the better a great many of the ordinary educational methods then in vogue. Although Seguin's work was of decided importance for the care and education of the feebleminded, it did not contribute very much to our understanding of the condition, and it remained for Binet to give us a deeper insight into the psychology of these children and to show us clearly the relationship between the feebleminded and the normal mind.

Definitions of Feeblemindedness. — The earliest definitions of feeblemindedness are legal in nature and Blackstone's may stand as an example of these: "An idiot, or natural born fool, is one that hath no understanding from his nativity, and is, therefore, by law presumed never likely to attain any." Other definitions are distinctly medical in type stressing the incomplete development of the brain.

Sociological. — The best modern definition, not specifically influenced by the work in mental testing, is that formulated by the British Royal Commission on the Feebleminded in 1904: "A feebleminded person is one who is capable of earning a living under favorable circumstances, but is incapable, from mental defect existing from birth, or from an early age, (a) of competing on equal terms with his normal fellows: or (b) of managing himself and his affairs with ordinary prudence."

Following closely on this definition, Tredgold (16), one of the best medical authorities on feeblemindedness, says: "We may accordingly define amentia as a state of restricted potentiality for, or arrest of, cerebral development, in consequence of which the person affected is incapable at maturity of so adapting himself to his environment or to the requirements of the community as to maintain existence independently of external support."

The definition of the British Royal Commission is essentially sociological in character, because it makes social competency the criterion for judging the mental status. Tredgold practically adopts this sociological viewpoint, but adds to it a physiological explanation in the phrase "restricted potentiality for, or arrest of, cerebral development." This physiological defect is due to "an imperfect or arrested development of the cerebral neurones."

Psychological. — The definitions given above may stand as samples of the best type of modern definition that has not been influenced by the mental test. The advent of scales for measuring intelligence naturally gave rise to a type of definition that referred to achievement on the scale as a criterion of feeblemindedness, and this type of definition we may regard as psychological. As a good sample of this we may quote Doll (17) who says that feeblemindedness is "a condition of arrested development, specifically of the general intelligence, which limits the individual to mental capacity not exceeding that of 12-year-old normal children." It is immaterial for our present purpose whether we use twelve, eleven or ten years as the upper limit for feeblemindedness. It is immaterial whether we express this

upper limit in terms of mental age as in the definition above, or whether, as some workers do, in terms of the intelligence quotient, using an I. Q. of 65, 70 or 75 as the upper limit. The important point is that the definition is now strictly psychological. It substitutes " mental development " for the physiological concept of cerebral development used by Tredgold. It lays stress upon " general development " as opposed to specific abilities. And finally, it mentions a specific mental age or intelligence quotient which can only be determined by the use of a scale of mental tests. The sociological results of this arrested mental development are not included in the definition, the assumption being that an individual of such restricted mentality will fall below the required sociological standards. This type of definition, therefore, is the direct outgrowth of mental testing, and it is the type that the psychologist finds most serviceable. Varying social standards make it difficult to determine who is or is not able " to maintain existence independently of external support." Ability to adapt oneself to one's environment cannot be measured as accurately as general intelligence can be measured by means of a scale or tests. Therefore, the psychological criterion of feeblemindedness by its objectivity and greater degree of exactness makes an appeal to the scientist which is lacking in the sociological criterion. The practical clinical psychologist must of course always take the sociological factors into consideration in his recommendations for commitment to an institution. For the protection of the individual and of society commitment or supervision is desirable for all those who are chronically unable to maintain themselves independently, and many of those may be above the limits of

feeblemindedness in the psychological sense of that term.

We see, therefore, that the term "feeblemindedness" is ambiguous, because it has a distinctly social and a distinctly psychological meaning. There is a real need for two separate terms. "Feeblemindedness," referring to those feeble in mind, might advantageously be restricted to all who possess a certain limited amount of intelligence as measured by standard intelligence tests. Those who are unable to adjust adequately to the social environment might be termed "socially feeble" and "social feebleness" might be used as the substantive for this status.

The psychological concept quoted above makes a mental age of twelve the upper limit of feeblemindedness. Present-day opinion is tending to lower this age considerably. Many psychologists would make ten the upper limit, and this would agree very nicely with the theory of mental age fourteen as being average adult mentality and an I. Q. below 70 as being indicative of feeblemindedness.

Statistical. — A mathematical, statistical or percentage definition of feeblemindedness was suggested at the same time independently both by Miner (18), and by Pintner and Paterson (16). This type of definition is a direct outgrowth of the hypothesis of a normal distribution of intelligence in the population at large. If intelligence is distributed normally among the population at large and if feeblemindedness is to be regarded simply as the possession of a limited amount of intelligence, we might agree to regard as feebleminded a certain definite percentage at the lower end of our distribution curve. The percentage to be regarded as

feebleminded will depend very largely upon whether we wish to limit the term to those conservatively termed feebleminded at the present time, or whether we wish to enlarge the concept and include within the term the highest grade cases about which there is now much difference of opinion.

A conservative estimate of the number of feebleminded, by which is meant, in the main, institution cases, would be less than one per cent of the population. A more liberal estimate, including high grade cases which at present society cannot see its way to segregate in institutions, would amount to two or three per cent of the population. The percentage decided upon is a mere matter of convenience and agreement. The practical value would be in diagnosis. Any individual falling below the score obtained by the given percentage on a well-standardized intelligence test would on that account be considered feebleminded.

The adoption of such a definition of the term " feeblemindedness " would immediately divest it of all its sociological implications. An individual would be termed feebleminded simply and solely because he fell in the lowest x per cent as determined by psychological tests. Volitional disturbances and defects of character would now no longer be considered cases of feeblemindedness, as they very often are at the present time. Some other term, such as " psychopathic," might be used to cover these cases.

In other words, then, most, if not all, the cases at present grouped under the heading " feebleminded," would be divided into two groups; (1) feebleminded, i.e., those testing below a certain level on standard intelligence tests, such standard being determined by the

lowest x per cent of the population at large; (2) psychopathic, i.e., those showing deviations in temperament or character such as is found among the lowest x per cent of the population measured by character and temperament scales, when such scales are available. At present the second group would be ill-defined, but the hope is that in the future psychological scales for the measurement of these traits will be available and that then individuals could be as accurately classified in this respect, as they are at present in respect to their intelligence.

This grouping of individuals would have no direct bearing upon social competency or incompetency, except in so far as social incompetency might result from either feeblemindedness or psychopathy. The socially incompetent form a much larger group than merely the feebleminded and the psychopathic, as we have defined these two groups. The socially incompetent group includes in addition the insane, many delinquents, and many others who are incompetent from purely environmental, accidental, or temporary reasons. And many who would be diagnosed by this method as feebleminded or psychopathic, would be socially competent in a simple environment.

It has been objected that this mathematical or percentage definition of feeblemindedness is a changing concept, in as much as it would differ from country to country and from century to century. This is true. There probably are differences in the degree of intelligence of the inhabitants of different countries, and in as much as this is true the standard for any one country would differ from that of another. This, however, would have no significance for the practical problem of feeblemindedness in any one country. Ultimately the upper

limit of intelligence for the lowest x per cent of the whole population of the world might be determined, but the possibility of this being done is slight and its practical value negligible.

As to the second objection that it might change from century to century, it is obvious that this is based on an optimistic belief in the development of human intelligence. In so far as the evolution of the human race indicates such a development, there would then be a gradual increase in the absolute amount of intelligence of the lowest x per cent, but relatively they would always be the least intelligent of the group and the least able to compete with their fellows. Eugenic measures tending to restrict the increase of this lowest group might help to raise the average mentality of the whole group.

The Prevalence of Feeblemindedness. — Before the advent of the intelligence test, estimates of the number of feebleminded in any country were very rare and for the most part based upon the number of cases confined in institutions for the feebleminded. Obviously these represented only a small proportion of the mentally feeble according to the newer view which arose from mental testing. Indeed, Kuhlmann (16–17) calculates that only about 4.5 per cent of the estimated number of feebleminded in the United States are taken care of in institutions for the feebleminded. A small percentage is to be found in penal and charitable institutions, a very large percentage is made up of children in school, but the largest percentage of all, namely, 51.6 per cent, is unaccounted for and represents the feebleminded at large among the adult population.

The British Royal Commission's estimate (1904) of the prevalence of feeblemindedness in a whole country

is the most important attempt not influenced by the concept of the mental examination. It is based upon a thorough canvass of sixteen typical areas in the British Isles and leads to an estimate of 0.403 per cent, or roughly about one half of one per cent. This is admittedly a very conservative estimate and is undoubtedly influenced by the medical conception of feeblemindedness, so that in all probability it refers largely to those cases in need of institutional care.

The wide use of intelligence tests during the last ten years has led to several attempts to estimate the percentage of feeblemindedness, and almost all of these have yielded larger percentages than that of the British Royal Commission. Some of the estimates given below are based upon the opinion of psychologists who have had a great deal to do with mental testing, while others are based upon the results of surveys conducted more or less with the help of intelligence tests.

Authority	*Estimated Per Cent Feebleminded*
British Royal Commission (Tredgold, 14)	0.40
Wisconsin, Dept. of Ed. Report (Cary, 16–18)	0.70
Oneida Co., N. Y. (Carlisle, 18)	0.73
Porter County, Ind. (Clark, 16)	0.90
Rural County, Ohio. (Sessions, 18)	1.80
Rural Survey, Del. (Mullan, 16)	1.80
Goddard (14)	2.00
Terman (16)	2.00
Cleveland Survey (Mitchell, 16)	3.00
X County, Cal. (Terman, 18)	4.24
X County, Minn. (Anderson, 22)	6.10

The variations in these estimates are very great and are due to the differences in opinion from authority to authority as to what constitutes feeblemindedness, as well as to some possible variation in the actual number of feebleminded among the different groups examined. There is, however, general agreement in the fact that all of them exceed the estimate of 0.4 per cent made by the British Royal Commission. It is probable, therefore, that the use of intelligence tests has enlarged our concept of what constitutes feeblemindedness and at the same time has enabled us to diagnose much more accurately and objectively than before. In addition to this we are getting into the habit of thinking in terms of different degrees of intelligence as represented by the mental age, intelligence quotient, percentile or index, and because of this we are less concerned as to the number below some hypothetical line which marks off the feebleminded from the normal. It is sufficient for us to know in general that according to present-day standards the probable number of individuals who ought to be taken care of in special institutions because of lack of intelligence is between 0.5 to 1.5 per cent; and further the probable number of people who need special education in our public schools and some social assistance in later life includes an additional 0.5 to 1.5 per cent. The percentage of feeblemindedness may be said to range from 0.5 to 3.00 per cent, according as we place the dividing line at an I. Q. of about 60 or 75.

The Types of Feebleminded. — Under this heading the earlier writers described almost exclusively certain physical or clinical varieties of particular interest to the medical profession. It is natural that the bizarre and peculiar should attract attention, even if we disregard

the morbid interest which such cases may excite. In addition some of these cases yield to specific medical treatment and are, therefore, of importance from a medical standpoint. With reference to other groups the close resemblance among the members of the group gives rise to the natural supposition of a specific causative factor which, if discovered, may give a clue to the effective treatment of the case. These clinical varieties are important medically, but not psychologically. They make up a very small percentage of the cases in any institution, and a much smaller percentage of the total population of feebleminded. Lapage (11), after describing six clinical types, says that, "91 per cent of the feebleminded are not of any special type."

These physical types generally include the Cretin, the Mongol, the Microcephalic, the Hydrocephalic, and sometimes the Paralytic and the Epileptic. This classification is very illogical, because individuals belonging to several of the groups are not always feebleminded, as is notably the case with the paralytic and epileptic, and also to a lesser degree the hydrocephalic. Again the groups overlap, because we may have a hydrocephalic condition in a microcephalic idiot, and epilepsy may appear in many of the other types.

Psychologically, these clinical varieties are of no interest, because the various groups are not differentiated as to general intelligence or any other mental characteristic. Cretins may range all the way from dullness to idiocy; mongolians from high grade imbecility or, perhaps, moronity to idiocy. Microcephalics are usually idiots, but this depends to some extent upon the size of the cranium we decide to call microcephalic. Hydrocephalics range from superior intelligence to low

grade idiocy, the amount of intelligence depending upon how severely affected the individual is. We find all grades of intelligence among the paralytic and the epileptic.

The use of mental tests has given us a classification of the feebleminded according to the amount of general intelligence possessed. Previous to their use, most writers had made a differentiation between idiots and imbeciles, and this seemed to rest upon a difference in amount of intelligence, but this simple quantitative difference is by no means explicitly described. Indeed it is more common to find the writer trying to describe qualitative differences, as, for example, when we find Sollier (01) maintaining that idiocy is lack of development, and imbecility a kind of abnormal development. The quantitative concept of intelligence was more definitely formulated by Binet, and the wide use of mental tests has now fixed absolutely the difference between idiots and imbeciles as a difference in amount. It is even now customary to define these different grades of feeblemindedness in terms of mental age, as follows:

Idiots, up to a mental age of 2
Imbeciles, mental age from 3 to 7
Morons, mental age from 8 to 10, 11 or 12

There is a difference of opinion as to the upper limit of moronity. Goddard seems to have been the first to suggest 12 as the upper limit. Many psychologists would now put the upper limit at 10.

This simple quantitative differentiation has greatly aided in the practical classification and grouping of children in institutions and schools. It is important that

feebleminded children of like mental age should be grouped together for training purposes. A grouping according to physical type is of no practical value. This quantitative concept has helped us more than any other one thing to a better understanding of feebleminded-ness. Before the widespread use of intelligence tests, there was a common opinion that the feebleminded were a different type or species of human being, separated off from the normal by a wide impassable gulf. Even as late as 1906, Norsworthy finds it necessary to emphasize in her thesis the fact that idiots "do not form a special species" and she does this by showing there is no gap between normal and feebleminded children in the results of various tests.

Idiots Savants. — Earlier writers on the feebleminded paid much attention to a description of idiots savants, that is, idiots or imbeciles who possessed an extraordinary talent in some special direction.

The descriptions of most of these cases are not very convincing to the modern psychologist, because they lack the quantitative measures of intelligence by means of which he could judge the performances described. To the old-fashioned observer, who thought of the idiot as a thing apart, belonging to a different species, it must have been a decided shock to find one who could recite pages of a school reading book from memory, or remember all the birthdays of the children in an institution or construct presentable objects out of wood, and so forth. To the psychologist, thinking in quantitative amounts of intelligence, it is no surprise to find individuals of mental ages from seven to ten doing these or similar things, when he considers what a mentality of seven to ten can accomplish plus the results to be

obtained by much practice, and making allowance for the presence of special abilities in limited amount among the feebleminded just as we find special abilities among the normal. All of the so-called idiots savants that it has been the privilege of the writer to see personally could readily be explained in this fashion. Those that are described in the literature are harder to account for, because we lack definite quantitative statements as to their intelligence level. One suspects in many cases that they were not technically feebleminded at all, being rather psychopathic or mildly insane types such as are to be found in most institutions for the feebleminded. The one case that has been described by Tredgold (14) at length was certainly not feebleminded. This man was called "The Genius of Earlswood Asylum," and possessed remarkable skill in drawing and mechanical ability. He constructed elaborate models of ships and carried them out in the greatest detail. We have no record of this individual's mental age. We know, however, that he was deaf and had a deaf brother, and that his parents were cousins. He never went to school and was, therefore, very uncouth and ignorant. In fact, he must have been like the average deaf child who has been allowed to run wild without training. He was sent to the institution at the age of fifteen and there he had the first opportunity to learn things. He was put to work in the carpenter's shop and as he made such excellent progress, he was given more and more opportunity to follow his interests. Tredgold himself says that he does not believe the man to have been "intrinsically defective." It would seem not. It would appear rather as if he were an untrained deaf child with more than average ability, all of which, owing to

the circumstances and his own interest, was turned in one particular direction. It is somewhat misleading to group such cases under idiots savants. They are not idiots and they are far from being savants.

Summary. — We see, therefore, that the quantitative conception of intelligence, which has arisen on the basis of intelligence tests, has very definitely influenced our ideas with reference to the feebleminded. The idea that feeblemindedness is simply a low degree of general intelligence has made our definition of feeblemindedness more accurate and concise. The introduction of intelligence tests has led to larger estimates of the number of feebleminded than were common previously, and greater interest in the question as to the prevalence of mental deficiency. If these estimates differ, it is not to be wondered at, because there is necessarily a difference of opinion as to the dividing line between feeblemindedness and merely backwardness, and also because there are differences between the accuracy of the tests used and the accuracy of the examiners in using them. Furthermore, mental tests have given us a classification of the feebleminded according to amounts of intelligence into the three groups of idiots, imbeciles and morons, a classification which is of much greater significance socially and educationally than one which emphasizes physical peculiarities. For the education and training of the feebleminded, the use of intelligence tests has been of special value. They have enabled us to group children of like mentality together. They allow us to forecast the type of training that is likely to be of advantage to a child according to his intelligence level; and they prevent us from hoping for too much improvement in individuals of

limited intelligence. It is no exaggeration to say that the introduction of intelligence tests has led to a greater advance in our understanding and training of the feebleminded than had been made since the early days of the Christian era when they were first brought together into asylums as objects of charitable care.

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CHAPTER IX

THE SUPERIOR

The Discovery of Superior Intelligence. — The child of superior intelligence has been discovered by the intelligence test. Previous to this time we have had geniuses, peculiar freaks and extraordinary prodigies, and the connotation attaching to such words as "genius," "prodigy," "precocity," and the like, indicates that they were regarded as something apart, as something unhealthy and slightly abnormal. We had to wait for the intelligence test to give us a saner viewpoint, to give us a better definition of superior intelligence and to show us that superior intelligence is not nearly so uncommon as we seem to have imagined.

Interest in the child of superior intelligence has been much slower in developing than interest in the child of inferior intelligence. This is due to two reasons: (1) the limitations of the earlier intelligence scales, and (2) the practical problems arising in the school situation.

The original Binet Scale was not well adapted to the discovery of superior intelligence, except in younger children, and the uncertainty of the standardization of the early American adaptations made workers hesitate as to the reliability of their results. In addition to this the scales were frankly constructed by Binet for the diagnosis of inferior mentality. The object was not so much to find out what a child could do, but rather

what he could not do. The great majority of children tested were cases suspected of mental deficiency, and, indeed, from this period there has come down to us the phrase "to submit a child to a mental test," carrying with it a suspicion of the integrity of his intelligence. To this same attitude can be traced the name "nut test," and other similar slang phrases. If the early interest had centered on the superior child, if our first tests had been constructed especially to diagnose superiority of intelligence, then to be given a mental test would have been looked upon as an honor or privilege.

There is a very good reason, of course, why mental tests should have arisen first for the diagnosis of the feebleminded. This reason lies in the difficulties ever present in the schoolroom in handling the dull and feebleminded child. These children make their presence felt very decidedly because they simply cannot keep pace with the rest of the class, however much attention and instruction they may get. Something had to be done with them and so the school pressed for a solution, and the psychologist was stimulated in his attempts by the recognition of a very real and practical problem. On the other hand, the superior child has never been considered a problem in the schools, mainly because he has never really been recognized. He almost always can cover the required work, and, doing so, fulfills the main requirement of the school. If he is unruly or mischievous, the school can and does deal more or less adequately with this type of behavior, even although it does not recognize that it may sometimes be a symptom of superior intelligence. Again the school greatly resents the suggestion that it cannot recognize superior intelligence, that it is necessary to have psychological

tests in order to discover it. Does it not daily and monthly and annually pile up a vast array of grades or marks, so that the sheep may be separated from the goats, so that it may reward its brightest scholars and admonish the laggards? In other words the school has in general tacitly assumed that amount of school work accomplished is a direct measure of general intelligence, and is only slowly beginning to realize the difference between educational attainment and general intelligence. Even today this distinction between knowledge and intelligence is not clearly in the consciousness of the teacher. She is more apt to assume that, because a child has done good work in the class in which he happens to be, he is therefore of superior intelligence. And, conversely, if he does merely average or poor work, he is, therefore, of normal or subnormal intelligence.

We do not mean to leave the impression that before the general use of mental tests no attention had ever been paid to children of remarkable ability. We find many references in literature to especially bright children, and the biographies of many great men bear record of their superior performances in childhood. Nevertheless, such references are scattered and leave the impression of something peculiar and very uncommon. Superior intelligence has certainly not been recognized as a vital educational problem. It is becoming to be so regarded today, because of the scientific study of such children by means of intelligence tests.

The Prevalence of Superior Intelligence. — If we raise the question as to the percentage of people of superior intelligence in the population at large, we find a different problem confronting us from the one as to the percentage of feebleminded. There has not previ-

ously existed any concept as to what is a person of superior intelligence, and, indeed, only a vague conception of the more common word "genius." There has never been any attempt to survey the population or a part of the population in order to find out the number of gifted individuals as in the case of the feebleminded. Furthermore, the concept of superior intelligence, being so vague and ill-defined, has not had attached to it social significance. It is free and clear of sociological meanings, in contra-distinction to the concept of feeblemindedness, which the psychologist inherited burdened with social interpretations.

This being the case the psychologist has practically formulated his own definition of superior intelligence and he is doing this at the present time by considering the upper 20 or 25 per cent of individuals tested by means of reliable intelligence tests as superior. This upper group of 20 to 25 per cent is then divided into two or three groups, such as "superior," "very superior" or "genius," and the percentage of individuals in these groups becomes progressively smaller as we ascend the scale. We see here, therefore, an acceptance of the statistical type of definition, which has been rejected in the case of the feebleminded, because of the older meanings attaching to that word. Superior intelligence, therefore, implies the possession of a certain amount of intelligence, measurable by means of intelligence tests, and it does not imply the possession of any desirable (or undesirable) social traits, or of any specific ability to compete with decided success in the world at large. As defined, therefore, it is quantitative and psychological; it is not qualitative and sociological.

The point fixed by Terman on the Stanford-Binet

Scale above which an individual may be considered of superior intelligence is an I. Q. of 110. The percentage of children having I. Qs. greater than 110 in his investigation was twenty. Future investigations may show a larger or smaller percentage falling above this I. Q. point. At the present time an I. Q. of 110 is by common consent regarded as the dividing line between normality and superiority.

Studies of Special Cases. — Before the use of mental tests the main interest in superior children centered very largely in the "prodigy," that is, the child of very exceptional attainments. In general the children of whom we have any record were made the object of educational experiments in order to see how much could be achieved by this or that particular method. In most cases the parents of the child participated actively in the work. The modern conception of inherited general ability is for the most part lacking, and the results obtained are attributed solely to the method of education followed. It will be of interest to mention a few of the outstanding cases.

In an old German book published in Goettingen in 1779, entitled "The Life, Doings, Travels, and Death of a very clever and very well-behaved four-year-old child, Christian Heinrich Heineken of Luebeck, described by his teacher, Christian von Schoeniech" (Berkhan, 10), we are given a description of one of the earliest prodigies on record. We are told that at ten months he learned the names of things on pictures. Before 12 months he had committed to memory the best stories in the five books of Moses. At 14 months he knew the stories of the Old and New Testaments. At four years he could read, but not write. He could add,

subtract, multiply and divide. He knew French and had learned 1500 sayings in Latin. He learned Low German from his nurse and knew the most important facts about towns and places in geography. His fame spread over Europe and he was summoned before the King of Denmark. The little prodigy, however, was always sickly and he died at the age of four years and four months, "a wonder for all time," his biographer pathetically remarks.

In many respects our little Christian Heinrich corresponds very nicely to the popular notion of a prodigy, namely that he is sickly and perhaps nervous, that he has a prodigious memory and dies early.

Let us turn to another historical case which is more hopeful. At the beginning of the nineteenth century Karl Witte (14), a German pastor, undertook the education of his son, believing thoroughly in the importance of education in the first five or six years of a child's life. "Natural aptitudes" are not nearly so important as we imagine, according to Witte. His watchword seems to have been the statement of Helvetius, which he cites repeatedly, "Any man, normally well endowed, can become a great man, if he is properly educated."

Witte maintains stoutly that his boy was only of average intelligence. These are the accomplishments of the child. He learns to read before he is four years old and picks up writing shortly afterwards. At six he begins the study of French and then in succession Italian, Latin, English, and Greek. At seven years and ten months he demonstrates publicly in a school his ability to read Greek, Latin, Italian and French. At nine he knows as much as a youth of 18. (Would his I. Q. be 200?) He shows his fitness to matriculate at the

University of Leipzig at nine years. He studies, when eleven, analytic geometry, and when twelve calculus at the University of Goettingen; obtains the Ph.D. degree at 14 and is made Doctor of Laws at 16.

Witte, the father, pursued no special method of education but spent a great deal of time with his boy. In spite of his statement that the child was only of mediocre ability, it would appear rather as if he had an intelligence quotient between 180 and 200. It is interesting to note that in a way Witte had our present-day conception of different degrees of ability distributed on a normal curve. He supposes that men's aptitudes are " capable of mensuration " and could be graded from one to 100 and continues, " the children who are born with aptitudes of 80, 85, 90, 95 and 100 are certainly as rare as those, thank Heaven, who are by nature step-motherly endowed with aptitudes of 25, 20, 15, 10, 5, and 1."

Karl, according to his father, remained a strong, healthy, playful child and never became vain and conceited. At 23 he was full professor of jurisprudence in the University of Breslau. Later he went to Halle where he remained teaching and writing for the rest of his life until death overtook him in full intellectual vigor at the age of 83. The dire prophecies of insanity and premature death that were launched at the father, because of " forcing " the young child's mind, were unfulfilled.

John Stuart Mill (Courtney, 89) is another of the infant prodigies of which we have a complete record. He was subjected to a strict and severe discipline by his father, who undertook his education from a very early age. He began Greek at three. " I faintly remember,"

he says, "going through Aesop's *Fables*, the first Greek book which I read. The *Anabasis*, which I remember better, was the second." Between the ages of three and eight he read many Greek authors, such as Herodotus, Lucian, Plato, and also in English such historians as Hume and Gibbon. It is comforting to learn that at this period the boy also read *Robinson Crusoe, The Arabian Nights* and other lighter literature. Between eight and twelve he studied Latin, Greek and Mathematics. The list of authors becomes formidable, including most of the well-known classical authors and shows a much wider range of reading than the average college undergraduate, who is studying the classics, is called upon to read. In Mathematics he studied geometry, algebra and differential calculus. He started to write a history of Roman government. He was interested in science and says, "I never remember being so wrapt up in any book as I was in Joyce's *Scientific Dialogues*." From twelve to thirteen he studied Logic and Political Economy. His father was harsh and irritable. Fear predominated in the education. He read many abstract things that he did not understand. "I never was a boy," he said, "never played at cricket. It is better to let Nature have her own way." It is evident that Mill was not happy, because of the temperament and attitude of his father. The system of education was not good, and none but a child of a very high intelligence quotient would have responded in the way Mill did. There are indications of "forcing," but the boy did not break down under it. On the contrary he lived to become one of the foremost of English logicians and political economists.

We have similar records of the early education of

Macaulay, the two Thomson brothers and others. James Thomson at twelve and his brother William at ten became regular students at the University of Glasgow, and both took many prizes there. James became a great engineer and died at the age of 70. William Thomson, Lord Kelvin, became famous in physics and died at the age of 83.

Rather different from the foregoing is the case of Francis Galton. He is not usually considered as one of the young prodigies, but rather as an example of slowly maturing genius, in as much as his chief work was done in later life after the age of fifty. Terman (17) has given us a summary of his childhood achievements as described in Pearson's *Life, Letters and Labors of Galton.* The little Galton was taught mainly by his sister, and was not subjected to any special educational procedure or method as was the case with the other children previously described. His sister taught the little Francis his letters in play, so that he could point to them before he could speak. By the time he was five he could recite much of Scott's *Marmion.* When two and a half years old, he could read a simple book, and he could sign his name before three years. During his fourth year he wrote a short letter to his uncle, which has been preserved. The day before his fifth birthday, he writes to his sister: "My dear Adele, I am four years old and can read any English book. I can say all the Latin substantives and adjectives and active verbs besides 52 lines of Latin poetry. I can cast up any sum in addition and can multiply by 2, 3, 4, 5, 6, 7, 8, 10. I can also say the pence table. I can read French a little and I know the clock. Francis Galton. Febuary (sic) 15, 1827."

Here we have a summary of Galton's achievements at five in his own words and, as Terman points out, we have reason to believe that all of it is true. There is much more evidence of his rapid intellectual development at succeeding ages, as shown by his letters and the books he was reading. At fifteen he was admitted to the Birmingham hospital as a medical student. After studying this evidence of intellectual superiority, Terman concludes that Galton's intelligence quotient must have been nearly 200, and his contributions to science in later life would certainly support this conclusion.

In addition to these and other cases of individuals now dead and of whom we have not intelligence ratings, there remain a few cases of very superior children who have been tested by means of intelligence tests and described in recent psychological literature. Garrison (17), Burke and Hollingworth report the case of E. who was 8 years and 4 months when tested, and obtained a mental age of 15.7, with an I. Q. of 187. In addition to this, E. did well on all other tests, except those involving manual dexterity. At the time of the test the boy was in the sixth grade. He was strong and healthy, but showed little inclination to indulge in games and sports. Both the parents showed high intellectual attainments.

In a report by the same writers (Hollingworth, 22) five years later we learn that E., when 12 years old, took the Thorndike college tests for entrance to Columbia College, and that he ranked second among 483 competitors, whose median age was about 18. On the Army Alpha he scored 194 and 201 on two different forms of the test. The boy entered Columbia College at the age of twelve, and, at the time the report was written, had attained a sophomore status. During his freshman

year all his academic ratings were B or better, with the exception of physical education in which he received a C. He seems to get along quite well with the other students and is described as a "good sport." In the five years during which E. has been studied, no tendency to become mediocre has appeared. During this time he has passed from 6th grade to 2nd year in college. "Average children, the country over, born when this child was born, and measuring 100 I. Q. when he measured 187 I. Q. are now in the 7th grade of the elementary schools." (Hollingworth, 22).

Coy (18) reports the case of a girl 9 years 10 months testing mentally 16 years 5 months with an I. Q. of 167 on the Stanford Revision. Other tests confirmed this mental age of 16. Her lack of schooling made her educational tests comparatively poor. In January 1917 she was in the fifth grade, but in June she was promoted to the seventh. She was thoroughly normal in all her social reactions, and indeed is described as being quite a "tom-boy." Both of the parents are characterized by high intellectual attainments.

Terman and Fenton (21) give a preliminary report of Betty Ford, chronological age 7.10, mental age 14.10, I. Q. 188 on the Stanford Revision. She ranks high in all other intelligence and educational tests. She shows a great interest and gift for the composition of poetry and prose, and much of her writing is considered to have intrinsic merit. The child has no known physical defects and always has been very healthy. Physically she is a year or so accelerated. Both parents are decidedly above average in intelligence.

Geniuses Who Were Dull in Childhood. — We cannot leave this topic of youthful precocity without calling

attention to the popular conception that many dull children later become brilliant. This popular idea is supported by many stories of the boyhood of great men which tell of their poor standing in school. The list of such men is a long one (Swift, 08). Linnaeus was advised to become a cobbler. Darwin was considered below the common standard in intellect. Napoleon was mediocre in military school. Newton was the last boy in his class. Samuel Johnson was indolent. Swift was only allowed to take his degree in college by "special favor." Wordsworth was shiftless. It was doubted whether von Humboldt had the ordinary powers of intelligence. Heine, of course, was a failure, because he revolted at the formalism of school and college. And so it goes with Lowell, Goldsmith, Richard Wagner, Pasteur and Gladstone. And, finally, we have the remark attributed to Hume's mother, namely, "Our Davie's a fine good-natured cratur, but uncommon wake-minded."

It is a pity we do not have intelligence ratings of all these people in their childhood days. All the evidence of modern psychology is against the opinion that a child of inferior or even average intelligence can later become endowed with superior intelligence. In so far as the men cited above were men of superior intelligence, we must conclude that they were misunderstood as children, or they were not given the right kind of education, or because of environmental causes or character qualities they did not utilize all their intelligence in their school work. As we shall see, this latter factor is common among bright children in our schools today. Many a bright child learns little in school or, worse still, learns bad habits of study or learns to

hate mental work, and the names cited above are probably historical examples of bright children who became valuable individuals in after life in spite of the handicaps of their education. History, of course, does not record the bright children, misunderstood and wrongly educated, who never became famous in later life.

Group Studies of Superior Children. — A comparison of two groups of high school seniors has been made by Yates (22). One group was composed of the 25 who scored highest on a combination of several intelligence tests, while the other group of 25 were those who scored around the median. The latter group are, therefore, not inferior in intelligence, but perhaps average high school seniors. If compared with the population at large, they would undoubtedly rank high. The differences between the two groups are interesting. The superior group get better academic marks; are rated higher in intelligence by their teachers; have more foreign parents; have fathers whose occupational status is higher; have the same type of homes in a material sense; have more "broken" homes (death, divorce, etc.); are not more likely to be "only" children; walk and talk earlier; are about equal in health; seem to mature earlier; have learned to read and write earlier; like school better; read much more widely. All of these conclusions are based on a very careful gathering together of the information required.

A study of 53 children with I. Qs. above 120 has been made by Root (21). The group surpasses normal children in their performance on about 19 psychological tests of all sorts of functions. In general the children come from good homes and the author lays much stress on the environmental influences.

Out of 776 high school students Almack and Almack (22) found 51 superior, i.e., having an I. Q. above 110. Thirty per cent of these were retarded in their school grade in comparison with their chronological age, and all, except three, were retarded in comparison with their mental age. Eight of them were rated "average" in intelligence by their teachers. The median academic grade was "A." They exceeded the Smedley norms in height, weight and lung capacity.

Terman (19) has reported a study of 59 children between the ages of 3 and 14 with I. Qs. above 135. Only 18 of these were girls. On the basis of chronological age the average acceleration of the group is about 2 years. On the basis of mental age there is an average retardation of 2.6 years. He finds that they are equal in health to the average; that they are markedly superior in moral and personal traits and are not likely to be "queer" or socially unadaptable.

In Germany and England interest is also beginning to be aroused with reference to the child of superior intelligence. Psychological tests are being used to discover these children. Stern (20) reports briefly several investigations conducted in Germany for selecting children of superior intelligence. In Hamburg the problem was to choose 990 children for a special curriculum in the fifth year of the elementary school. In Berlin a special three-year high school course was organized for boys of superior intelligence. Several similar investigations are also described. Stern emphasizes the necessity for considering other factors besides the result of the intelligence examination. The decision should rest on (1) the teacher's judgment of the pupil's ability; (2) the school record; (3) the teacher's psychogram of

the pupil; (4) an educational examination; and (5) the intelligence test.

In England Ballard (22) reports the use of intelligence tests "to discover gifted children worthy of free secondary education among elementary schools of the county of Northumberland." Several educational committees in other parts of England seem to be employing tests for similar purposes.

Special Classes for Superior Children. — Some of the most important studies of superior children have been made for educational purposes and we shall describe briefly the results reported by some of the workers.

Whipple (19) during 1916–17 conducted an investigation as to the mental tests which might prove most valuable for the selection of gifted children. For this purpose a class composed largely of superior children was formed and conducted as a special class for one year. Especially instructive in this report is the very conclusive evidence as to the inability of the teacher or principal to select the children of superior intelligence as defined by the psychologist. The thirty children for the Special Fifth and Special Sixth, as the Superior Class was called, were selected by the teachers. Considering an I. Q. of 110 and above as superior, there were 11 out of 30 below this line, the lowest of the I. Qs. being 99. And conversely, in the classes from which the superior children were selected, twenty children considered as average or below by their teachers were tested. Six of these proved to have I. Qs. above the median I. Q. of the Special Group. The child with the highest I. Q., namely 167, was not chosen by the teachers, but was discovered by means of the mental tests. The teachers, therfore, is likely to consider

as superior, children who are merely normal, and to consider as merely average some children who are decidedly superior. Hence the imperative need of mental tests in selecting superior children. The average I. Q. of the Special Fifth was 119 with a range from 102 to 146; the average I. Q. of the Special Sixth was 116 with a range from 99 to 133. These two groups were, therefore, not entirely composed of superior. Nevertheless, these two classes easily completed two years of the ordinary school curriculum in one year. Only nine failed to accomplish this double amount and of these nine cases, seven were not superior according to the criterion of mental tests. The superiority of this group, as a whole, is further demonstrated by Whipple by means of numerous mental and educational tests.

Coy selected and supervised for two years a class for gifted children. All of the children composing this class were selected by intelligence tests. If reliance had been placed upon teachers' judgments solely, fifty per cent of the brightest children would have been ignored. The I. Qs. of the children ranged from 114 to 156 with an average of 129. The class covered three years of the regular curriculum in two years and some of the children who started one half year behind, covered three and a half years of the regular curriculum. In addition to the regular work, extra cultural studies, such as Greek History and French were pursued, and the regular school studies were conducted on a broader basis. Standard educational tests were used to measure the progress at repeated intervals, so that the educational attainment was not based upon the subjective judgment of the teacher or investigator. At the end of this period they were promoted to an ordinary eighth grade

class in which they more than held their own among children much older chronologically. The careers of these children have been studied for one year after they left the special class, that is, down to June 1921. Their further progress, if followed, should be of great interest and value. Much of importance in this special class, which the writer himself watched, cannot be stated in quantitative terms. The spirit of the class was excellent and there was no problem of discipline. Children who had never known what hard mental work was, experienced it for the first time and learned their powers. Other children realized for the first time that they had serious competitors in the world, and this realization had a sobering and healthy effect upon their characters. Instead of fostering a spirit of "snobbishness" or "superiority," the special class brought a spirit of healthy, hard work, and eliminated any tendencies towards "snobbishness" which existed and which are more likely to flourish among superior children in the ordinary class-room where they run the risk, sometimes, of being held up as models.

The parents of the children were all very satisfied and most of them were loud in their praises as to what the special class had done for their children. To the writer this moral and character-building influence of the special class was particularly interesting, because it is from this angle that the policy of segregating superior children has been especially attacked. When we have adequate scales to measure moral and character qualities, we shall be able to state such progress in quantitative terms.

In Detroit, special classes for bright children have been in operation since 1915, (Cleveland, 21). Since

1917, the children for such classes have been selected on the basis of mental tests. In 1921, there were three centers with over 200 pupils. The emphasis is placed upon a broader and richer curriculum, although the progress is also more rapid than in the ordinary class. The teachers of these special classes are enthusiastic about them, and we quote from one of them: "In my thirty-five minute period with this eighth grade class, I accomplish as much as in a forty-five minute period with ninth grade pupils. The comprehensive questions asked have in several cases surprised me — questions which would never occur to the average student. The problem of discipline does not exist. I have found an eagerness to learn, a deep sense of responsibility toward work assigned and a courtesy unparalleled in my teaching experience."

Children of superior intelligence are to be found in poor homes as well as in the homes of the well-to-do. Specht (19) describes a superior class formed in a public school on the lower East Side in New York City. The children were selected by means of intelligence tests and all of them had I. Qs. above 120. The median chronological age was 10.6, the median mental age 14.4, and the median I. Q. 137. During the first term they covered more than two grades of the regular school curriculum, and during the two subsequent terms they covered two grades each term. Many additional subjects were also studied. At the time the report was made, all of the children had entered high school and were doing well there.

Physical and Moral Characteristics. — The popular conception of a youthful prodigy is that of a pale, sickly, nervous child, wearing glasses, avoiding the usual

games of childhood, eventually becoming neurotic or insane, and, if not dying prematurely, at least developing into a useless member of society because of the over-cramming of his mind with useless knowledge. Although this conception is gradually weakening, it is nevertheless still common, and it evidently has been long prevalent. Over a century ago, Pastor Witte was warned of the dire consequences that would result, the insane asylum, and so forth, if he persisted in continuing his method of education with the youthful Karl. We find him, therefore, taking great care of the health of his son, and he presents evidence of his son's good health and interest in games and the out-of-doors.

It has been the custom for writers on superior children to study carefully these factors in view of the prevailing popular notions. The special class children studied by Coy were as healthy as the control group, if not more so. They seemed superior in moral and social characteristics. Terman's analysis of 31 children with I. Qs. of 125 or above shows their health conditions to be fully up to the average for the school. In rating them according to moral traits, only one child was found with unfavorable traits which might be considered serious. For the majority only favorable moral traits were reported. Terman (19) sums up the testimony of their teachers as follows: "Such children are fully as likely to be healthy as average children: their ability is far more often general than special, they are studious above the average, really serious moral faults are not common among them, they are nearly always socially adaptable, are sought after as playmates and companions, their play life is usually normal, they are leaders far oftener than other children, and notwithstanding

their many really superior qualities, they are seldom vain or spoiled."

In a comparison of children in special advanced classes in Detroit, with children in ordinary classes. Elizabeth Cleveland reports an impression of "more complete physical fitness." This is expressed in posture, in nervous control, and in a general look of contentment and well-being.

Gillingham (19, 20) is more severe in her judgment on the bright child than the above-mentioned writers. After a detailed study of many such children, she concludes that many of them are poor in muscular control, many are lazy and "will not apply themselves to 'dig,'" some are very inaccurate, some are very babyish in their social attitude, a large number are neurotic, and lastly, she concludes that "the keenly intellectual person is almost invariably egocentric."

All this evidence is extremely valuable, even although some of it is based upon mere opinion. It is tending to sweep away our pre-conceived notions as to the abnormality of genius and the undesirability of paying special attention to the education of the superior child. There is no need to be afraid of "forcing" his mind; there is more danger in leaving it neglected without adequate mental nourishment.

There seems little danger of such children becoming vain and conceited, because of being given special educational advantages. The school and the teacher will undoubtedly impress upon them the fact that exceptional ability involves exceptional responsibility.

Future Problems. — At the present time our knowledge of the superior child and the proper treatment for him is merely beginning, and there are numerous un-

solved problems in this field. On the one hand, we need more knowledge about the superior child, and such knowledge will shortly be forthcoming from the extended program of research mapped out by Terman (22). This plan proposes a study of 1000 children of superior intelligence. Information as to educational attainment, moral and emotional traits, anthropometric measurements, interests, heredity and the like, will be gathered.

On the other hand, we need more experimental work in our schools. The superior child is slowly emerging as a definite educational problem with which the school is being called upon to deal. Just now, we are experimenting by organizing special classes or else by accelerating such pupils to a moderate degree. But there are many problems that still remain unsolved. At what stage in their school career is it most desirable to segregate such children? So far, very little has been done in the first grade or kindergarten. Might it not be most profitable to begin as early as possible, before the child has the opportunity of forming bad habits of learning? What is to be done in the small school where there are not enough bright children of similar mental age to form a class? In other words, how can we apply the knowledge that we now have about the education of superior children, so that their education may become a regular part of the elementary school system, whether in the large city or rural school? In the large city system the possible advantages of a special building for superior children should seriously be considered, just as it has been found advantageous for feebleminded children. Such a building would allow a better classification into more homogeneous groups, and the curriculum for the whole building could be modified to meet any needs thought desirable.

Shall the emphasis be placed upon rapid promotion or upon a broader and richer curriculum? Do these two aims necessarily exclude each other? Shall we not find that both can readily be realized? What shall be done with the superior child who is ready for high school at an age much below the average? Is he able to take part in the social life of the high school, and if he is, is it injurious or advantageous to him?

Again these same problems will confront us with reference to college. Is the very young freshman missing anything vital in education, because of the discrepancy between his age and the age of the average freshman? If he is losing anything, we must ask further whether this is more serious than being kept back in his mental development by the conventional rate of progress through school. Will these supposed drawbacks in high school and college be really serious if we have a fair number of younger bright children scattered through the high school or college? In the large city school system, we must also consider the advisability of setting aside one high school for children of superior intelligence. In such a school, the average chronological age will be much below the average of an ordinary high school. The social activities in such a school would conceivably be very different from those usually found in the present-day high school. Whether such a segregation would be desirable or not, only experiments can show.

At any rate, there is no doubt that our present system of dealing (or rather not dealing) with the superior child is decidedly wasteful. A great amount of good intelligence lacks opportunity for development, and the modern democratic state is greatly in need of all of

it. It is axiomatic that such a democracy needs an intelligent citizenship, and hence the importance of free universal education, but it is just as important for a democracy to develop the right kind of leaders. It must, therefore, help to develop to the utmost all the desirable capacities of all its citizens.

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CHAPTER X

THE SOLDIER

We have repeatedly referred to the intelligence testing conducted in the Army during the years 1917 to 1919, and in this chapter we shall mention some of the important conclusions from that work. The detailed results of the whole work have been admirably presented in the Memoirs of the National Academy of Sciences, and we shall, therefore, make our statement very brief.

The title of this chapter, "The Soldier," must be understood to refer to the man in uniform during the period of the World War and not to the soldier in time of peace. The results are thus more characteristic of the general male population of the United States than they are of the professional soldier. As a matter of fact, the vast majority of the men tested were those inducted into the army by means of the Selective Service Act. We do not know whether the professional soldier of our ordinary peace-time army is the same as or different from the average drafted man. It is in the latter sense that we are using the term "soldier" in this chapter.

Because of the fact that the army in 1917–19 represented a fair sampling of the male population of the country, our data are of great importance. Up to the present time the army data represent the widest and most random sampling of adults that has ever been

tested. To what extent the group of drafted men is selected it is impossible to say. We may note, however, several selective factors which were at work to cut off the population at the upper and lower ends of the supposedly normal curve of distribution of intelligence:

1. Superior men tended to become officers in the army.
2. Many superior men immediately volunteered their services and were not included in the draft.
3. Some superior men were undoubtedly excluded from the draft because of being employed in essential industries. Whether exemption for "essential industries" excluded more superior than inferior men it is difficult to tell, but probably the former is the case.
4. Many inferior men were excluded by the draft boards because of being mentally unfit for service.
5. Many inferior men were not included in the draft because of confinement in prisons, workhouses, reformatories, almshouses, and the like.
6. The most inferior men were in institutions for the feebleminded.

The largest percentage, 51.1%, of exemptions or deferred classifications in the draft was given for "Dependency." It is doubtful whether this group can be considered superior to the drafted group. Lincoln (22) points out that in general the more intelligent man stays longer at his education and, therefore, is likely to marry later than the less intelligent. He is also generally economically more successful. Both of these factors would keep him from claiming exemption on account of dependency.

It may be, therefore, that these various selective forces, at work at both ends of the intelligence scale,

roughly balanced each other and made the average drafted man a fair representative of the general population.

The Army Tests. — The work in the army extended from September, 1917 to January, 1919. Psychological testing was established in thirty-five camps and altogether 1,726,966 men were tested either by means of group or individual tests. This total includes 42,000 commissioned officers. Individual examinations to the number of 82,500 were given. The psychologists recommended 7800 for discharge for mental defect, or 0.5 per cent of the total examined. They recommended 10,014 or 0.6 per cent for labor battalions because of low intelligence, and 9,487 or 0.6 per cent for assignment to development battalions for training and observation for possible use in the army.

The tests used in the army were Alpha, a group test for literates; Beta, a group test for illiterates and foreigners; and individual tests such as the Stanford, Point Scale and Performance Scale.[1] The tests correlated well with various estimates of intelligence. "Alpha yields correlations with other measures of intelligence as follows: (1) with officers' ratings of their men .50 to .70; (2) with Stanford-Binet measurements, .80 to .90; (3) with Trabue B and C Completion tests combined, .72; (4) with examination Beta, .80; (5) with composite of Alpha, Beta and Stanford, .94; (6) in the case of school children Alpha correlates with teachers' ratings .67 to .82; school marks .50 to .60 .....Beta correlates with Alpha .80; with Stan-

[1] For significance of letter ratings used on the group tests and for table of equivalent scores for the several tests used, see tables at end of this chapter.

ford .73; with composite of Alpha, Beta and Stanford .91." (Yoakum, 20.)

The Average Intelligence. — If we ask what was the average intelligence of the drafted man, we may most readily understand the result after the scores on the various tests have been converted into mental ages. These mental ages were equated with the Stanford Scale and they may, of course, be too low, if the standardization of the Stanford Scale was based upon children of better than average mentality. This has been done for a sampling of the different groups studied as follows:

	Mean M. A.	No. of Cases
White draft	13.1	93,965
Colored draft	10.4	18,892
White officers	17.3	15,544

The white draft is a fair sampling of the soldiers pro-rated by states as far as possible. The negro draft is also pro-rated by states with an additional group from the northern states.

We, thus, have the surprising and unexpected result of a mental age between thirteen and fourteen for the average white soldier. It is this result expressed in terms of mental age that has led to much popular discussion and misunderstanding. What it means is that the average drafted man does as well on the particular tests under discussion as the average thirteen to fourten-year-old child. This result was arrived at by equating the scores on Alpha with the mental ages obtained on the Stanford Scale by a group of some 653 soldiers, assuming that the standardization of the Stanford Scale for children is accurate and that thirteen-year-old ability on that scale

represents what thirteen-year-olds in general can do. This is probably true, for we have in addition the work of Proctor (21) and Kohs working with children alone. On the basis of results from several thousand school children they make a score of 60 (the average for the soldiers) equal to a mental age of thirteen. Similarly Doll (19) tested 514 school children and found that a score of 60 on the Alpha was the average for children between ages 11 and 12. In rural schools Lufkin (21) found a score of 60 to lie between ages 12 and 13. In addition to this we have the evidence from examination *a* in the army, which was the group test given before Alpha was introduced. A comparison of the median scores on this test for soldiers and children gives the following results:

	Median Score	No. of Cases
Soldiers	161	15,140
Children, C. A. 13	157	389
" C. A. 14	170	274
" M. A. 12	145	25
" M. A. 13	173	35

It would seem, therefore, that the kind of ability demanded by the army tests is such that it does not increase much, if at all, beyond the age of thirteen or fourteen in the average individual. This is only true in so far as the men tested in the army are taken to represent a general sampling of the population at large. The implications of this for intelligence testing have already been referred to in previous chapters.

Mental Age Distribution. — The army data also give a distribution of the white draft according to mental age as follows:

Mental Age	*Per Cent*
16 and over	14.0
15	9.3
14	13.6
13	15.8
12	17.0
11	12.7
10	7.6
9	4.7
8	3.15
7	1.75
6	0.2
5	0.1
4 and below	0.1

In so far as this represents the distribution of mental ages likely to be found in the country at large, it is important. The old definition of a moron, as having a mental age from twelve to nine, would result in some thirty to forty per cent of the men being classed as morons or worse, and it is these results interpreted in this way that have led to very absurd statements in popular and semi-popular writings. As we have noted elsewhere, that conception of a moron was rapidly disappearing even before the army testing.

A study of the table shows us a much larger percentage of cases in the lower mental age groups than we might have suspected, and more evidence of this sort may lead us to still further revise our concept of feeblemindedness. On the suggested basis of an adult mental age of fourteen and an I. Q. of 70 or below signifying feebleminded-ness, we should have all those testing below a mental age of 9.10 as probably feebleminded. This basis from the above table would give a percentage of almost ten

as probably feebleminded, a percentage much higher than any estimate of feeblemindedness for the general population than has ever been suggested. In this connection it is interesting to notice the experience of the psychologists in the army camps and the working basis which they arrived at: "In general, subjects whose mental age is below eight should be seriously considered for discharge or development battalion. Those whose mental ages range from eight to ten should be considered for use in special service organizations or for assignment to development battalions." In 674 cases given individual examinations at a certain camp, practically all below a mental age of eight were recommended for discharge from the army. Only 12.4 per cent of the men given individual examinations who were recommended for regular service fell below a mental age of ten, and only 0.3 per cent below a mental age of eight. The suggestion here seems to be that a mentality of eight or less (comprising about 2.5 per cent) is likely to be of no use to the army. Those between eight and ten can probably be used, but may need more than average supervision. Perhaps this latter group would correspond to the moron in civil life, as being a person who needs more or less help or supervision. In civil life he is more likely to fail and get into difficulty, because there is lacking the constant supervision given in the army. Indeed, it would seem that the army might very well make use of individuals of this level of mental ability for the many simple and routine tasks which have to be done, because the army provides just that degree of routine and supervision which is helpful and valuable for individuals of this level of mentality.

Again the evidence from a study of certain disciplinary

cases in the army shows the inability of the man of lower mentality to make the proper adjustments in the long run. Of 479 cases studied, 66.4 per cent fell below a C rating (average rating) and only 10 per cent above it; 20.7 per cent of these cases were rated D — or E, as compared with 7.1 per cent for the white draft.

Age and Intelligence. — To the extent that the age of thirteen or fourteen represents the limit of growth for the abilities tested by the Alpha examination, we should not expect any increase in ability from one year to another after age thirteen or fourteen. An examination of the scores of men in the army from ages twenty-one to thirty shows no evidence of increase, but the data in reference to this question are very scanty.

The relation between age and intelligence among officers has been carefully studied. The median score seems to decrease steadily with age, as follows:

Age	21–22	23–24	25–26	27–28	29–30	31–40	41–50	51–60
Score	146	146	147	143	141	133	125	120
No. of Cases	985	2330	2434	2101	1665	3963	1635	240

The correlations between age and intelligence range from —.01 to —.19, showing a slight tendency for the score to decrease with age. As to whether this is due to an actual loss in intelligence or a difference in the selection of the various age groups, it is impossible to say.

Rank and Intelligence. — "There is a high positive correlation between the rank and the intelligence of the enlisted men. The relationship among the officers of the various ranks is not so clear." (Memoirs, 21, p. 855.)

Type of Service and Intelligence. — As far as officers are concerned, there was a great difference in the in-

telligence of different branches of the service. Below are shown the percentages of officers rating A or B (the two highest ratings on the test) and also the median score on Alpha.

Branch	*Per Cent A and B*	*Median Score*
Engineers	97	162
Field Artillery	93	150
Sanitary Corps	90	151
Field Signal Bat.	88	149
Machine Gun Bat.	87	141
Infantry	85	140
Quartermaster	78	134
Medical	77	129
Dental	75	123
Veterinary	61	117

These differences are greater than any due to chance and suggest either an actual difference in the men attracted to various professions or the selective factors at work in various professions or selective factors at work in the choice of officers for the different branches of the service in the army. A more detailed study by Cobb and Yerkes (21) of the medical group has been made, because of its peculiarly low position in the group, which is contrary to the popular opinion as to the intelligence of men in that profession. The authors conclude that the method of selection of medical officers accounts for most of the differences as they were taken without training in officers' training schools, and thus, missed the selective factors operating there. "The Medical Corps obtained the services of the ablest as well as the weakest men of the profession." And finally,

"It is reasonably certain, then, that age and method of military selection are largely responsible for the relatively low intelligence of medical officers."

Education and Intelligence. — The amount of education an individual can acquire is determined among other things by his intelligence. From the important and lengthy analysis of the amount of education previously obtained by the soldiers in the army, we shall note only the increase in score with amount of schooling as shown by the white draft:

Median Score	Grades 0–4	5–8	H. S.	College	Graduate
Alpha	22	51	92	118	146
No. of Cases	4,253	33,424	10,715	3,131	97

Conclusion. — In this chapter we have noted merely a few of the more outstanding facts resulting from the intelligence testing in the army. This extensive and important piece of work was done under the pressure of war-time conditions. It was done for a very immediate practical purpose, and not for purely abstract scientific reasons. It demonstrated conclusively that intelligence tests could be of great value in the organization of men, and that they could be easily and economically applied. General intelligence, as tested by the army tests, is one of the factors contributing to success in the complex of military efficiency. Incidentally the results of the army testing have shed a great light upon the mental make-up of the population as a whole, for the soldier during the war was a fair representative of the citizen of this country.

For further details of the army testing, the reader must be referred to the original sources mentioned in the bibliography. We shall have occasion in several

other chapters to make use of the data as they apply to other topics treated in this book.

TABLE OF EQUIVALENT SCORES OF TESTS USED IN THE ARMY

Alpha	Beta	Point Scale	Complete Performance	Short Performance	Stanford Binet
					4.0
			3	2	4.5
			4	5	5.0
			6	8	5.5
			9	12	6.0
		31	17	17	6.5
		36	30	24	7.0
	2	42	41	33	7.5
	6	46	52	42	8.0
2	11	51	62	53	8.5
4	17	55	72	67	9.0
7	24	60	91	86	9.5
11	30	64	114	108	10.0
16	37	68	135	127	10.5
21	42	71	153	144	11.0
27	47	74	166	158	11.5
33	53	77	175	169	12.0
40	58	79	183	179	12.5
47	63	81	189	188	13.0
56	67	83	195	197	13.5
63	71	85	201	205	14.0
71	75	87	208	214	14.5
78	78	88	216	223	15.0
85	81	90	223	232	15.5
93	84	92	230	241	16.0
102	88	95	237	250	16.5
114	91	98	244	259	17.0
125	95	100	251	267	17.5
137	99		258	275	18.0
147	104		268	283	18.5
161	108		290	291	19.0

BASIS FOR THE ASSIGNMENT OF LETTER GRADES

	Alpha	Beta	Point Scale	Complete Performance	Short Performance	Stanford Binet
A	135–212	100–118	Not given	260–311	275–308	18.0–19.5
B	105–134	90–99	95–100	240–259	250–274	16.5–17.9
C+	75–104	80–89	90–94	215–239	220–249	15.0–16.4
C	45–75	65–79	80–89	190–214	190–219	13.0–14.9
C–	25–44	45–64	70–79	150–189	145–189	11.0–12.9
D	15–24	20–44	60–69	90–149	85–144	9.5–10.9
D–	0–14	0–19	0–59	0–89	0–84	0– 9.4

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CHAPTER XI

THE SCHOOL CHILD

Studies of the intelligence of the ordinary school child are very numerous, and it is not the purpose of this chapter to attempt to describe them all, but rather to indicate the different objectives of such studies in general and to give samples of the results so far obtained. Apart from the theoretical interest attaching to a knowledge of the intelligence of school children, its growth, distribution, and correlation with teachers' estimates and school work, we may say that the chief practical uses of tests up to the present time have centered around their value for the purpose of classifying children into more or less homogeneous intelligence groups, and also for predicting their future success in school work. These two purposes are intimately bound up with each other. Classification in homogeneous groups is justifiable because intelligence correlates highly with school success, and, therefore, the more homogeneous the group the more likely are the children in the group to advance together at about the same rate, be that rate relatively fast, normal, or slow. Intelligence is not by any means the only factor making for success in school, but it is a very important factor, and, therefore, the value of intelligence tests in educational administration and classroom procedure is very great. The results of the experimentation of the past ten years indicate fully

the significance of the work. We shall give some account of the studies that have been made, and we may most conveniently divide them into two groups, namely, those that have used individual tests and those that have used group tests.

Individual Tests

Sample Studies. — The earlier studies of school children were naturally made by means of individual tests before the advent of group intelligence tests. Most of these early studies were very narrow in scope, and they were more in the nature of trying out what the tests could accomplish. One of the earliest is that by Decroly and Degand, who in 1910 tested 45 children in a private school in Belgium ranging in age from two to twelve years. These children belonged to a good social class and the authors found that they all tested fairly high. Decroly and Degand were inclined to suppose that Binet's norms were not satisfactory.

The testing of children to pick out the feebleminded was one of the most common purposes with the earlier workers, as we have indicated in Chapter VIII. Here belongs the work of Irwin, who in 1913 tested 201 unselected children and found 72% normal, 12% backward and 16% feebleminded. About the same time Dougherty (13) reported the testing of 483 public school children, ages six to seventeen, giving the results in terms of numbers of years retarded or accelerated in mental age. This author is among the first to suggest that tests should be used for the purpose of classifying school children in general, although no such classification on the basis of results is reported. In 1914, the

year following, Adler reports the actual classification of children based on their test records. She tested seventy first-grade children and divided them into two sections of thirty-five each on the basis of the test results. The superior section completed two terms work in one term. In the same way eighty-nine fourth-grade children were examined and the best thirty-six cases put together in a faster-moving section, and twenty-two of these children covered two terms work in one term. About the same time Hicks (15) discusses the value of the Binet tests for kindergarten children. Thirty kindergarten children were tested and these results were then compared with their later work in the first grade. The author concludes that the tests have high prognostic value and that they should be used for the purpose of classifying children in the kindergarten and first grade.

These must suffice as examples of the earlier reports on the application of tests to the general school problem of classification. From this period onwards the value of tests in this regard is generally accepted. Nevertheless, we do not find many studies showing actual application of test results to school work. Undoubtedly the method was employed in some schools and the results not published. Let us look at three more recent studies with individual tests used for classification purposes.

Dickson (20) reports the classification of children in the low first grade in a school in a poor district into three groups: (1) A border zone with I. Qs. 85 or below; (2) a dull normal group, I. Q. from 75 to 95; (3) a normal group, plus a few who tested superior. The results of such classification are reported to have been very satisfactory after watching the children for

a year and a half. Special emphasis is laid upon the necessity for segregating the duller children.

Pintner and Noble (20) report the attempt by means of individual tests to readjust all the children in a school having grades I to VI. After testing all the children, readjustment on the basis of mental age was attempted so far as feasible. The results of the tests were made one of the important factors in determining promotion from one grade to another. Of the 370 children examined, 22 were skipped one whole grade, 47 were skipped one half grade, 41 were retained in the same grade, 5 were demoted one half grade, one was demoted one whole grade, and the rest promoted the customary half grade. Two classes for specially bright children were formed in the IA grade and the IIA grade, and an ungraded class was formed. A comparison of the school before and after the reclassification shows 56.7% of the pupils normally placed in grades for their mental age before reclassification, as compared with 71% rightly placed after the reclassification. Principal, teachers and superintendent reported favorably as to the progress of the children after reclassification.

Davis (22) reports the use of the Binet tests for first grade children in a city school system. The kindergarten teachers gave the tests, so that all prospective candidates for admission to the 1B grade had mental age and intelligence quotient determined. Of 277 tested first graders, 81% with an M. A. of 6 and over were promoted from 1B to 1A, but only 59 per cent of those having M. A.'s between 5.8 to 6.0, and zero per cent of those below M. A. 5.8. On the basis of this type of experimentation, the author says, "in the future it will be our policy to limit entrance to the first grade,

TABLE III. — PERCENTAGE DISTRIBUTION OF INTELLIGENCE QUOTIENTS

Author and Cases	Intelligence Quotient											
	40–9	50–9	60–9	70–9	80–9	90–9	100–9	110–9	120–9	130–9	140–9	150–9
Terman (19) 112 Kindergarten Children			0.9	4.5	11.6	19.6	25.0	20.5	12.5	2.6	1.8	0.9
Mitchell (22) 1113 Kindergarten and 1st Grade	0.2	2.9	8.1	15.4	23.7	20.5	18.9	7.3	3.1			
Terman (19) 149 1st Grade	0.7	4.7	8.7	18.8	20.1	14.1	16.8	8.7	4.7	1.3	1.3	
Pintner (20) 450 1st to 5th Grades			1.6	4.2	10.9	49.6		20.9	8.4	4.4		
Terman (19) 137 1st Yr. H. S.				0.9	6.6	29.0	23.3	21.4	14.0	4.6		
Proctor (21) 116 H. S. Pupils				0.9	4.2	22.4	17.2	27.6	18.1	9.5		

	56–65	66–75	76–85	86–95	96–105	106–115	116–125	126–135	136–145
Terman (17) 905 Unselected all ages	0.3	2.3	8.6	20.1	33.9	23.1	9.0	2.3	0.5
Whitcomb (22) 2360 Kindergarten and 1st Grade	1.8	4.5	10.3	22.3	27.0	22.1	8.1	2.8	0.8

in so far as feasible, to pupils who have attained a mental age of Six."

The Distribution of Intelligence by Individual Tests. — There are numerous reports of individual tests of unselected school children, in addition to those we have already mentioned. Some of these studies did not aim at any practical purpose in school work. The results of many of these are interesting from the point of view of the general distribution of intelligence. Table III

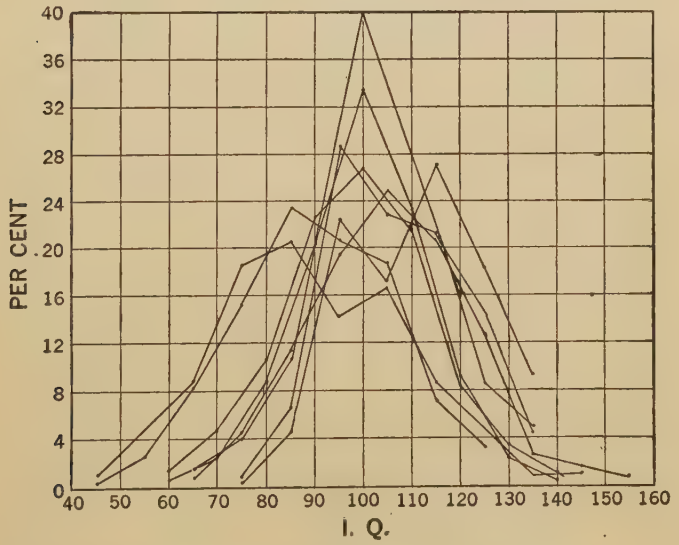

FIG. IV

Percentage Distribution of I. Qs. from eight Different Studies of School Children.

gives the percentage distributions, according to I. Q., of reports of various groups of unselected children. All studies do not report the results in the same steps of

I. Q., hence the two types of distribution shown in the table. Terman's (17) results of 905 unselected cases at all ages is the group upon which the standardization of his Stanford Revision is based and it is, therefore, approximately normal with the mode at I. Q. 100. It is interesting to note how the other groups deviate from this normal type and are shifted either to the upper or lower end of the distribution. Figure IV gives the general effect of all the distributions shown in Table III, and here we note how all the curves together give the general impression of a normal distribution, and also the shifts to the right and to the left. The two middle curves with the modes about 100 are those of Terman and Whitcomb. The two shifted most to the left are those of Terman (19) for 149 first graders, and of Mitchell, also for primary children. The one shifted most to the upper end is the one for Proctor's high school students.

Any single group, grade or school may vary quite markedly from the general distribution assumed for unselected children. The selective factors of social status and grade in school are at work. When we compare the distribution for the high school groups with the elementary school groups we note at once the large percentage of cases with I. Qs. above 120 and the smaller percentage with I. Qs. below 90 in the high school. The school itself is a rigorous selective agency. The inequality between groups is strikingly shown by comparing the first three reports of primary children. The group of 112 kindergarten children tested by Terman must have been very superior, whereas those tested by Mitchell rather inferior and the first graders tested by Terman very inferior. Whitcomb's distribution at the

bottom of the table shows a kindergarten group very normally distributed with percentages much like Terman's standard group for all ages combined.

The great differences in intelligence that may be expected in the same grade in different schools or in different rooms of the same school are well shown in Terman's (20) report of the intelligence of five first grade classes:

Room	*Median M. A.*	*Median I. Q.*
1	5.7	76
2	6.0	87
3	6.0	85
4	7.2	108
5	7.8	112

Here we range from a group whose median I. Q. denotes borderline mentality and in which there are probably many feebleminded children, to a group whose median I. Q. denotes superior intelligence and which, therefore, contains more than fifty per cent superior children.

Mental Age Standards for Grading. — In the placing of school children in grades in terms of their mental age, what mental age standards should be adopted? On the assumption that the average age of school entrance is about $6\frac{1}{2}$ years, Terman (20) gives the following standards:

Grade	*Mental Age*
I	$6\frac{1}{2}$ to $7\frac{1}{2}$ or about 7
II	$7\frac{1}{2}$ to $8\frac{1}{2}$ or about 8
III	$8\frac{1}{2}$ to $9\frac{1}{2}$ or about 9
IV	$9\frac{1}{2}$ to $10\frac{1}{2}$ or about 10
V	$10\frac{1}{2}$ to $11\frac{1}{2}$ or about 11
VI	$11\frac{1}{2}$ to $12\frac{1}{2}$ or about 12

VII	$12\frac{1}{2}$ to $13\frac{1}{2}$ or about 13
VIII	$13\frac{1}{2}$ to $14\frac{1}{2}$ or about 14
High School I	$14\frac{1}{2}$ to $15\frac{1}{2}$ or about 15

The median mental ages actually found according to Terman (19) are as follows:

Grade	*Median M. A.*	*No. of Cases*
I	6.10	341
II	7.11	189
III	9.0	181
IV	9.11	253
V	11.0	226
VI	12.1	236
VII	13.1	193
VIII	14.2	180
H. S. I	15.4	137

Group Tests

In spite of the enthusiasm manifested by psychologists and educators in the intelligence tests as a help in many of the problems of the school, we find relatively few whole schools tested until the appearance of the group test. The individual test is obviously too expensive and tedious to use with a large number of children. It requires from 30 to 90 minutes to test a child, and more training on the part of the examiner than is required by the group test. Up to the last few years there existed quite a bit of suspicion and skepticism on the part of psychologists themselves as to the reliability of the group procedure. With the appearance of many well-constructed group tests and after much experimentation with them, their suspicion and skepticism have entirely disappeared. Let us discuss, therefore, some of the dif-

ferent types of studies made by means of group tests in (A) Elementary Schools and (B) High Schools.

A. Elementary Schools

Community Differences. — One of the earliest studies is reported by Pintner (17), who gave a set of group tests to the school population of an Ohio village. This was given as part of a general social survey of the community. The year following Paterson (18) reported the results of the same group test given to the school population of a Kansas town, also in connection with a general social survey of that community. We may, therefore, well describe these two studies together. The percentage distribution of the children as diagnosed by the tests is as follows:

Mental Rating	*Kansas*	*Ohio*
Very Bright	4.2	0.7
Bright	15.6	5.8
Normal	66.0	65.6
Backward	11.4	25.3
Dull	2.4	2.6
No. of cases	332	154

The median mental index of the Ohio children is 40 (10 below normal), while that of the Kansas children is 51 (1 above normal). It is obvious that the Kansas group is superior mentally to the Ohio group. This difference in mentality is probably indicative of a like difference in the mentality of the adults in the respective communities, and it may be a determining factor in the different social conditions of the two communities. The social surveys show a decreasing population in the

Ohio community and an increasing population in the Kansas community; a lack of reading in the Ohio homes, plans to increase library facilities in the Kansas town; poor recreation facilities in Ohio, a recreation director in Kansas, and so forth. In general, therefore, there seems to be a better social condition in the Kansas town than in the Ohio village, and this healthier social condition may be ascribed in part to the superior mentality of the Kansas population. These studies are merely beginnings of what seems to the present writer a splendid opportunity for the coöperation on the part of psychology and sociology in a deeper study of community differences. It is interesting to note that no similar studies have appeared, so far as the writer is aware.

Comparison of Different Schools. — That children in different schools, whether in the same school district or in different districts, show enormous differences in general intelligence is shown abundantly by group intelligence tests. Because of the use of different group tests and different methods of rating intelligence, it is unwise to attempt a general tabular summary of these studies for comparative purposes. Results from a few samples studies will be given. Pintner (18) with the same tests, as used in the two previously mentioned studies, compared four city schools, a village school and a rural school. The median percentiles of the four city schools were 58.5; 58.5; 47; 44.5; for the village school, 30; and for the rural school, 17. Differences in the actual native ability of the various groups examined and not differences in the methods of teaching and the like are presumed to be the reason for this variation.

A comparison of two similar cities is made by

Pressey (19), involving 1049 cases in City A and 1009 cases in City B, made up of children in grades III to the first year of high school. The two cities show much the same type of pupil material although there are great differences between schools in each city. The percentage of children in City B scoring at or above the median of City A at each age is:

Age	8	9	10	11	12	13	14	15	16
Per cent	68	59	51	47	51	54	47	50	50

A slightly greater percentage of cases than the 10 per cent expectation in City B fall below the 10 percentile score of City A at the ages for which the results are more reliable.

Coxe (21) reports the results of the Otis test given to 24 sixth grades in 24 elementary schools in Cincinnati. The average score ranges from 61.8 to 100.1, or in terms of mental age from 10.8 to 13.10, and yet all these children are supposed to be covering the same curriculum.

Dickson and Norton (21) gave an abbreviated form of the Otis test to 1043 eighth grade pupils in 29 schools. The median scores for these different schools ranged from 48 to 109 with a median score for all pupils of 83. Here again we see the tremendous differences in mental make-up from school to school. Individual scores range from 14 to 152 points, and yet the pupils represented by this tremendous range in ability are all in the same grade and are all supposed to be doing the same work. Comparisons with sixth and ninth grade pupils are made, and the authors say, "It is evident that ability as measured by the test in the eighth grade classes in some of the schools is equal to

that in a freshman class which has survived a year in high school and is just ready to begin sophomore work; while the ability found in other eighth grades is no better than that of groups of children who have not yet completed the sixth grade. If the test means anything in terms of ability to do school work, certainly the actual accomplishments of the different classes graduating in January, 1920, must have varied widely."

A survey of all the schools in a small city by means of several intelligence tests was made by Holley (20). In all, 2030 children in all grades in the eight elementary schools and the one high school in the city were tested. Although there are differences in the median scores for the same grade from school to school, the differences are not very striking. Evidently the mental make-up of the various sections of this city is fairly similar on the average. Again a study of the tables showing the distribution of the I. Qs., as calculated from several group tests combined, for each school and each grade separately, shows great similarity from school to school. There are, however, great variations among the grades. The highest median I. Q. for any one grade is 117 and the lowest 93. The percentage distribution of I. Qs. for the total 2030 cases is:

I. Q.	*Per cent Pupils*
150–9	0.2
140–9	1.0
130–9	4.0
120–9	11.4
110–9	22.9
100–9	26.3
90–9	19.7
80–9	8.9

70–9	4.0
60–9	1.4
50–9	0.5

The median I. Q. is 1.06. The distribution is fairly symmetrical with a slight skewness towards the higher I. Qs. The town is a university town and this may account for the higher percentage of brighter pupils as contrasted with the backward group.

An extensive survey of the schools of Utah is reported by Snoddy and Hyde (21) in which more than 15,000 children were tested. The differences in mental ability of different schools or communities are not given and the authors content themselves with total distributions of those taking the elementary and those taking the advanced examinations respectively. The two curves for these groups show very close approximations to the normal probability distribution.

Comparison of City and Country Children. — Book (18) uses the results of a survey of 1165 children in several schools in grades III to VIII to draw a comparison between city and country children. The median scores for each age for the two groups are as follows:

Age	*City*	*Country*
8	67	50
9	74	58
10	93	62
11	105	89
12	116	97
13	125	107
14	122	110
15	115	117

Thus at each age, with the exception of age 15, the elementary school children of the city show higher intelligence scores than those of the country. The author remarks, "If we take the years 8 to 13 inclusive for the city and country we find that only 24 per cent of the country children rate above the medians for the city and only 2 per cent score above the highest 10 percentile of the city children. Of the country children 27 per cent rate below the lowest 10 percentile for the city." Whether the difference as suggested here is true of the country as a whole as compared with cities in general, we do not know. Pintner's comparison of schools mentioned above showed the village and rural schools below the city schools, and other workers have suggested the same thing. The difference between the two groups reported by Book is very great and some of it, but probably not all of it, may be due to the fact that the city with which comparison was made is a small city in which a university is located. Nevertheless, what data we have at the present time would lead to the conclusion that rural districts stand lower in intelligence than urban districts.

Overlapping in Ability. — Madsen's (22) tests of 12,000 children bring out strongly the facts as regards the overlapping of ability among children in different grades. He also uses the data to show the well-known fact that the older children in a given grade are the duller and the younger are the brighter. He shows for each grade facts similar to those which we give below for grade IV:

Average I. Q. at age						
8	9	10	11	12	13	14
142	107	86	62	56	59	46

In this grade the youngest children have an average I. Q. of 142 and the oldest of 46. There is, of course, no criticism necessarily implied in this sort of distribution, provided the mental ages of the children are more or less equal. In the above distribution this is not the case. Turning the data into mental ages and considering age 8 as equivalent to 8 yrs. 6 mos., and so on for the other ages, we get the following facts for grade IV:

Average M. A. at age

8	9	10	11	12	13	14
12.1	10.2	9.0	7.2	7.0	7.11	6.8

Here again we see that the younger children of C. A. 8, 9 and 10 are in absolute intelligence above the older children of ages 11, 12, 13 and 14. If, as Terman says, a mental age of 10 should be the standard for grade IV, we might expect the following I. Qs. for children of different chronological ages:

Average I. Q. for age

8	9	10	11	12	13	14
118	105	95	87	80	74	69

A comparison of this ideal arrangement with the one actually found by Madsen shows much less difference in the spread of I. Qs. for the different chronological ages.

Terman (22) discusses this problem of overlapping or the heterogeneity in intelligence within a given grade and shows many sample distributions. He says, "The condition may be summed up by the statement that, in general, from 20 to 25 per cent of the pupils of a given grade have attained a mental age about as high as the median mental age of the next higher grade, while the lowest 20 to 25 per cent in the same grade are about

as low in mental age as the median for the next grade below."

Classification in Practical Use. — The work of Brooks (22) may be mentioned as a good example of the use of group intelligence tests in a school district by a practical school man in the field. His distribution of 592 children according to grade and ideal mental age (allowing two years as normal for each grade, e.g., M. A. 6 to 7.11 for grade I, 7 to 8.11 for grade II, etc.) shows 89 cases or 15 per cent of the pupils working "above or below their mental capacities. Of these 7.1 per cent are working above or trying to, and 7.9 per cent are working below." He then goes on to show how to improve the grouping of the children taking into consideration the practical necessities of the school situation. He shows a decided preference for the intelligence test as contrasted with the achievement test for classification purposes.

The educational achievement of children in grade VIIB sectioned on the basis of intelligence tests is reported by Theisen (22). After one semester's work the classes were tested by means of standard educational tests and the brighter sections were shown very definitely to have covered much more ground than the others. Most interesting in this report are the comments of the teachers upon this method of sectioning classes.

B. High Schools

General Surveys. — One of the most extensive surveys of high school pupils by means of intelligence tests is that undertaken by Book (22), who tested 6188 seniors in 320 high schools in the State of Indiana. This cross-

section of the high school seniors of the state shows some interesting results. For purposes of rating, arbitrary intelligence grades A, B, C, D, E, F are assigned and the percentage of seniors at each grade is as follows:

Intelligence Grade	A	B	C	D	E	F
Percentage	8	14	52	13	12	1

As in the elementary schools, so also in the high schools we find enormous differences in the mental make-up of different schools and of different communities. To quote the author:

"1. In some schools all members of the senior class possess a superior or very high grade of intelligence. That is to say, all members of the class will be rated A or B, or A, B and C+.

"2. In other schools all members of the senior class rank very low, none scoring above the median for the state. In a few schools the entire senior class would make scores which entitled them to only a D, E or F intelligence rating.

"3. In still other schools a large proportion of all the senior class may possess a C, or average grade of mental ability.

"4. In a fourth type of school there is a marked irregularity among the members of the senior class. Some individuals possess very superior mental ability. Other members of the same class will merit a ranking of E— or F. This situation is much more likely to be found in the smaller high schools. The larger high schools are better graded and seem to have eliminated all inferior students before they reach the senior year."

Comparing communities instead of individual schools, great differences in intelligence are likewise found.

Book gathered information from the pupils as to whether they were planning to go to college or not, and he found that pupils of all grades of mental ability from the highest to the lowest were planning to continue their education in college in about equal numbers. "Almost as many students possessing E and F grades of intelligence are going to college as merit a ranking of A+ or A." Unfortunately for the colleges many of the brightest students were not planning to go to college at all. Of those rated A+, 22 per cent, A 24 per cent and B 28 per cent did not expect to go to college; while of those ranking D and E, 64 and 62 per cent, respectively, intended to go to college. The average rating of those intending to go to college is only slightly higher than that of those not intending to go. We seem to be failing, therefore, in seeing to it that the best intelligence of the high school is given a college education. This is surely important, regardless of what our attitude may be with reference to encouraging or discouraging those of inferior intelligence in their college intention.

The school progress of these high school students reveals the fact that in general promotion is controlled by the calendar rather than by ability or accomplishment, and this to a greater extent than in the elementary schools. "It seems to be a habit of high school officials to keep their students in the high school for four years regardless of their ability to do the work." And again, "Most individuals possessing superior or very superior intelligence have been only regularly promoted by the high school."

An analysis of the vocational ambitions of these seniors is interesting and shows the great need of advice and guidance. As far as their choices are con-

cerned, we note that the average score of the boys selecting science, the ministry and journalism is the highest; whereas those selecting medicine, business, farming, stenography or a skilled trade rank lowest. In this connection it is interesting to note the low position of medicine in view of the relatively low standing of the medical officers in the army. There are many other items of interest in Book's survey and we shall have occasion to refer to some of them later on.

Differences in the intelligence of different cities and in different schools of the same city are shown by Madsen's (21) survey by means of the Army Alpha test of 7168 students in four cities. The median scores reported by him are as follows:

				Omaha		
	Madison	Rockford	Sioux City	Central	Commerce	South
Seniors	121	124	138	135	111	110
Juniors	122	120	130	132	102	118
Sophomores	109	107	122	122	94	114
Freshmen	96	94	108	107	85	93

In each city there is an increase in score as we ascend from the freshmen to the seniors, with the exception of the Madison seniors. The less intelligent students are eliminated from year to year. The differences between cities are marked, Sioux City being much superior to Madison and Rockford, and showing about the same median scores as the Central High School at Omaha. The differences between the three Omaha schools are greater than those between the first three cities.

Many other reports of intelligence tests of high school pupils show much the same results as we have given below, and these reports must serve as samples.

Comparison of City and Country Children. — A comparison of city and country high school children shows a similar superiority of the city children as we found in the case of elementary school children. Hinds (22) gives the following results in terms of the coefficient of brightness on the Otis test:

	Median Intelligence	*No. of Schools*
City High Schools	100.5	164
Affiliated Town Schools	98.0	290
Small Town Schools	84.4	59
Rural Schools	77.0	68

The author says, "These tests represented as nearly average groups of students in each type of school as it was possible to obtain. This being the case, the conclusion seems to be justified that the country child is lower in general mentality, as measured by the group mental test, than the city child. . . . It should not be forgotten, however, that for years there has been a steady migration of the country's best to the city. Lincolns come from rural districts, but they never go back."

Book's (22) survey of high school seniors also shows that rural high schools rate decidedly lower than the city high schools and this is true in every section of the state. The median scores on his test are as follows:

	Northern	*Central*	*Southern*
City	141	141	136
Rural	134	135	130

He warns us, however, that we must not forget that children of all degrees of intelligence are found in all types of schools.

Practical Use of Tests. — The results of intelligence

tests in high school have been used for educational guidance and for classification, and a few such reports may be mentioned here. The most interesting attempt to use the tests for educational guidance is reported by Proctor (21). Children entering the high school indicated the subjects they desired to take, their future educational plans with reference to college, normal school and the like, and also their vocational ambitions. In addition to this, the educational counsellor had a record of their grades in the elementary school as well as their intelligence ratings on the Army Alpha and Stanford-Binet Tests. The tests function as one item in helping to guide the students in arranging their course of study. Proctor gives many interesting samples of individual cases, and then compares the first year's work of a "guided" group of children with another group of "unguided" cases. The facts are as follows in terms of per cent:

	Out at Work	*Out by Transfer*	*Failed 1 Subject*	*Failed 2 or More*
Guided	4.5	9.1	18.2	0.0
Unguided	12.1	13.1	30.8	10.3

The two groups were practically equal in intelligence, having median I. Qs. of 105 and 108. Evidently guidance in the choice of studies has saved many from failure or elimination from school, and, as the author says, "it is certain that the methods applied in this instance, if employed in any high school, would prove greatly superior to the wasteful trial and error methods that now prevail." In the same study Proctor gives the median I. Qs. for various groups of high school students, as follows:

First year students	105
High School graduates	111
Those going to college	116

The lower limits in terms of I. Q. below which there is little chance for success in high school or college, as at present organized, should be found, in order to help the educational counsellor in his work.

The classification of eighth grade pupils on the basis of intelligence tests is reported by Dickson (20) and their success in high school studied. Two groups, "regular" and "accelerated," were formed and the "accelerated" group covered the eighth grade work in one semester. After a year's work in high school the "accelerated" were compared with the regular high school students with whom they had been competing and were found to be quite superior in scholarship, in spite of being 17 months younger. Dickson also reports sections in English, algebra and arithmetic formed on the basis of intelligence tests, and quotes the testimony of teachers with reference to the value of such classification.

There are many other studies describing experiments in classification and the results seem uniformly to be good. These samples, however, must suffice here.

Combined Mental-Educational Tests

The methods proposed by various workers for combining intelligence and educational tests in school measurement have been discussed in Chapters IV and VI. All these suggestions are relatively new and so far very few studies showing actual use in school work have been reported. We shall give a brief description of a few.

Pintner and Marshall (21), using the scheme of mental and educational indices, report results from 56 schools of various sizes, both city, village and rural. They show how the combination of mental and educational tests may be used to pick out the children who are not working up to mental capacity, and in the same way classes and entire schools not making use of all the intelligence possessed by their pupil material may be discovered. They go on to point out that this double measure is the only fair way to make comparisons as to the relative efficiency of different schools or school systems. The usual comparison between schools as to gross educational accomplishment is not a fair measure of efficiency. They show how schools vary extraordinarily in the extent to which they are utilizing the intelligence of their pupils. In general, children possessing superior intelligence are the ones who are not working up to possible accomplishment, and the final verdict is that our educational system is failing to make use of vast stores of intelligence which lie hidden and undiscovered.

Murdoch (22) reports the Achievement Quotients of all pupils in grades III to VIII in a private school. Separate A. Qs. for reading and arithmetic were calculated. Because very high and very low scores on our educational tests do not have equivalent educational ages, the author was forced to make hypothetical extensions of the scales at both ends. This is the difficulty and drawback of the combined educational age and mental age method upon which the A. Q. depends. The author's results show most of the class A. Qs. in reading above 100, and in arithmetic 4 above 100 and 6 below. The A. Qs. were found useful in helping to reclassify the

children. "Often it [the A. Q.] was particularly useful in indicating that some pupil already at the 95 or 100 percentile for his grade should be advanced to a higher grade, because his A. Q., in spite of his high grade standing, was low." She further finds that in the case of many gifted children more accomplishment should be demanded because their A. Qs. were far below 100. The A. Q. also indicated children who required special testing, and lastly, it was used to evaluate the teaching efficiency of the teachers.

That the classification of pupils into homogeneous groups helps to raise the A. Qs. is pointed out by Torgerson (22). A sixth grade showed an increase in reading ability from an A. Q. of 114 to 162 during one semester when pupils were classified according to intelligence, as contrasted with an increase from 100 to 114 the previous semester when they were not so classified.

The Achievement or Accomplishment Quotient is stressed by Stebbins and Pechstein (22) as being the best measure of the efficiency of the teacher. Children in grades IV to VII were tested by means of an intelligence test and several educational tests. The median A. Qs. for the various grades show that in general those made up of the duller pupils receive the higher A. Qs.

These are samples of the newer type of work, that is now being done, in the application of intelligence and educational tests in the school. In the future the school survey will have to take into account the intelligence of the pupil-material. No real evaluation of school work can be obtained without an intelligence rating of the pupils.

Relation of Intelligence to Achievement

Almost all the studies mentioned in this chapter and very many others discuss the relationship between the results obtained on the intelligence tests and educational achievement, be the latter measured by objective educational tests or by school marks or by teachers' estimates of ability. A detailed discussion of the literature on this subject would require almost a book in itself. We can only give here a random sampling of the results obtained.

One of the most detailed and elaborate studies is reported by Gates (22). School achievement was measured by means of three objective educational tests in grade I to about 16 in grades III to VIII. Intelligence was measured by the Stanford-Binet and by seven to ten group intelligence tests, both verbal and non-verbal. The correlations of the educational tests with the three types of intelligence tests are as follows:

Grade	*Binet*	*Verbal Group*	*Non-Verbal Group*
I	36	..	30
II	44	..	23
III	47	65	22
IV	42	54	22
V	51	49	17
VI	67	57	29
VII	..	52	08
VIII	..	47	−15

There were about 20 pupils in each grade.

Burt (21) does not give his results for each grade separately. He reports a correlation of .91 between the Binet tests and school work for 689 children rang-

ing in age from 7 to 14. The partial coefficient, with age constant, is .68.

Some correlations between intelligence tests and high school marks are as follows:

Author	*Coefficient*	*Group*	*No. of Cases*
Book (22)	28	High School Seniors	5748
Book (22)	47	" " "	124
Proctor (21)	55	" " Freshmen	107
" (21)	34	" " Pupils	494
" (21)	41	" " "	480
Madsen (21)	40	Average, Grades IX to XII	428
West (21)	60	" " " " "	173
Miller (22)	52	High School Freshmen	55

Some examples of correlations between intelligence tests and specific subjects may be quoted. Gates (22) found the following correlations between Binet tests and certain subjects measured by educational tests in three grades as follows:

Grade	*Reading*	*Arithmetic*	*Spelling*
IV	36	35	11
V	41	25	37
VI	69	30	45

For a large group of children, age 7 to 14, Burt (21) reports correlations between the Binet and school marks as follows:

Composition	63
Reading	54
Dictation	52
Arithmetic (Problems)	55
Arithmetic (Mechanical)	41
Writing	21
Drawing	15
Handwork	18

Hollingworth (18) in a study of spelling reports correlations of 16 to 47 for various groups of children between Binet tests and spelling ability.

For high school subjects Book (22) reports correlations as follows between intelligence tests and:

English	44
Mathematics	37
History	25
Chemistry	52
Latin	26

Bright (21) reports correlations between a group test of intelligence and school marks as follows:

Latin	65
English	72
Algebra	50
Handicraft	36

Proctor (21) reports a correlation of 46 between Binet tests and algebra.

We note, therefore, in practically every case a positive correlation between educational achievement and intelligence. The coefficients range from very small ones to very high ones. Coefficients between 30 and 60 seem to be most frequent. The great variation in these coefficients is due to many factors, such as, the homogeneity or heterogeneity of the group, the reliability of the educational ratings, the great differences in the intelligence tests used, the range of ages included in any one group, the thoroughness with which education and intelligence have been measured in each case, and other similar factors. In general, however, the results clearly indicate that the thing measured by our intelligence tests is one of the factors making for success in school work.

Conclusions. — It is evident from the survey in this chapter of the use of intelligence tests with school children that such tests are at present being used very widely and for many different purposes. They have not yet come to be considered an integral part of every school system, but the time is not far distant when they will be considered as essential for the health, happiness and advancement of every child, just as a good school system now considers as necessary, physical examinations, adequate physical exercise, suitable buildings and equipment, adequately trained teachers, and the like.

At present tests are being used for the purpose of classifying children into more or less homogeneous groups. Often this results in the formation of separate fast or slow sections, not in the sense of extra sections for the deficient and the very superior, but simply as being relatively quicker or slower than the middle or normal group. All reports of such classification are favorable, and justice is being done to all types of children by this procedure. The teacher is helped, for her work becomes more uniform and even. She is not continually distracted by the maladjusted child. Discipline is greatly improved, for sufficient interesting work will keep the child out of mischief. A natural corollary to this movement of sectioning according to ability will be the gradual differentiation of the course of study in terms of the capacities of the various groups of pupils. Little has been done in this respect, but the indications are that attempts in this direction will be made now that the individual differences of pupils have been so clearly demonstrated.

The results of intelligence tests are also being used to help determine the promotion, acceleration or demotion

of pupils. The re-adjustment of a whole school or the proper adjustment of an individual is greatly helped by an adequate intelligence measure. Children may often be stimulated by promotion or acceleration, even though their school work is none too good, if they possess the requisite amount of intelligence. We have noted again and again the reports of bright children not working up to capacity and the reaction that often occurs when they are confronted with tasks that challenge their ability. Demotion of the slow who have been pushed along by a mechanical system of promotion is seldom reported by workers and it seems to be regarded as of questionable value. If so, it means that in future we must be more critical of our methods of promotion and not allow the dull child to move on to higher grades simply because of his chronological age, and by so doing to become a burden to the teachers in those grades.

A third use of intelligence tests that we have noted is in the fields of educational and vocational guidance. All are agreed that intelligence tests are simply one item in helping to give educational and vocational advice. They can, however, be made to function admirably if judiciously used. Because a child has a certain I. Q., there is no reason to believe he will follow with profit a certain type of training or make good at a certain job. Interest, desire, will-to-succeed, previous training and many other factors enter into the problem. But, unless he has a certain I. Q., we may now say, with a fair degree of certainty, that his chances for success in this educational course or in that vocation are very small or zero; and conversely, if he is above a certain I. Q., we may encourage him to go on with certain studies or to pursue certain ambitions.

A fourth use of intelligence tests, particularly when combined with educational tests, is the adequate rating of schools and teachers. In addition, their possibility for adequately measuring the value of different methods of teaching is indicated. So far relatively little has been done along these lines in actual school work. However, we now know that the quality of the pupil-material must be taken into account in measuring the efficiency of a school or teacher or the value of a teaching method. Undoubtedly the near future will see much work with combinations of intelligence and educational tests.

Apart from these practical uses of intelligence tests in the schools, this chapter has described the importance of test results in indicating the individual differences among children. The presence of such differences has, of course, always been more or less recognized. We are now, however, measuring them accurately for the first time, and the differences are greater than was ever suspected. Schools and classes differ radically in the intelligence caliber of their pupils and so do communities. Light has been shed upon the much debated question of the relative intelligence of city and country children, and, so far, both in the elementary and in the high school, the verdict seems to be in favor of the city child. But the work in this field is only beginning and the future should see important studies in community differences. Geographical, economic and industrial conditions are not the only reasons for the success or failure of communities, towns or cities. The mental make-up of the inhabitants will surely be shown to be of great and far-reaching importance.

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CHAPTER XII

THE COLLEGE STUDENT

The college student has from the very beginning pre-eminently been " the dog " upon which the psychologist has experimented in the laboratory. Working almost always in a university the psychologist has found an abundant supply of willing and valuable observers among the student body. The science of psychology is greatly indebted to their help and assistance, and they themselves have likewise profited by this closer and more intimate contact with psychology. It is not surprising, therefore, that we should find mental testing of college students at a very early date in the history of our subject. As we have indicated in Chapter I, the work was begun very early by Cattell, who in 1890 reported results of tests on students at the University of Pennsylvania, and again in 1896 on students at Columbia.

The first tests used were of a decided sensory and motor type and were mostly given as individual tests. Later on more distinctively mental tests were employed, both individual and group, until in recent years the group intelligence test, as we now know it, is most commonly used. Our treatment of the vast amount of work on the testing of the college student must necessarily be somewhat sketchy. It would be impossible and unnecessary to give a minute description of all the studies.

We will divide this chapter into the following sections:
i. Miscellaneous group and individual tests, under which will be included the earlier work before the introduction of the army tests, as well as some studies using miscellaneous tests which have appeared since that time;
ii. The Army Tests, under which will be given a summary of the main results by these tests, or by modifications of these, on college students;
iii. The Thorndike Tests, used at Columbia University;
iv. Conclusions.

1. *Miscellaneous Group and Individual Tests.* — It might be truly said that there is practically no mental test which has not been tried out on college students, and very few upon which we do not have reports of some sort or other. The reports range from a few tests tried out on a few students to many tests tried out on a great number; from studies of an incidental nature to studies in which a group of students has been intensively tested. All of the studies are more or less concerned with the reliability of the tests, but particularly with the problem of the value of psychological tests for predicting success in college work. We find, therefore, a great many correlations between test results and academic grades. A sampling of such correlations is given below. In this list the coefficient of correlation is often an average of several coefficients between tests and different academic subjects. Sometimes it refers to only a few subjects and a limited class of students, such as a group of freshmen; at other times it may be obtained from a combination of many academic grades or may contain students of several college years. All of these factors will, of course, affect the coefficient.

Correlation between Tests and Academic Grades

Author	*Coefficient*
Wissler (01)	09
Calfee (13)	23
Rowland and Lowden (16)	37
Waugh (16)	41
Bell (16)	31
Hollingworth (16)	50
Kitson (17)	44
King (17)	27
Haggerty (18)	65
King and McCrory (18)	38
Uhl (19)	43
Rogers (20)	55
Carothers (21)	21

It will be noticed that the great majority of coefficients are below 50. Coefficients of correlation between certain tests or particular groupings of tests and specific academic subjects vary around the coefficients given in this list from negative coefficients up to high positive coefficients of about 90, but in general the relationship between psychological tests and academic success is not very high. There are many other important elements entering into success in college studies besides the one of intelligence. Furthermore, the college student is very homogeneous in general intelligence as compared with the population at large, and this homogeneity of the group diminishes the correlation. Nevertheless, as many of the authors point out, the results of judiciously chosen tests may help very decidedly, along with other facts about the student, to advise the student as to his work and to help the administrative officers in problems of dismissal or suspension. Kitson's (17) sugges-

tions in reference to vocational guidance are valuable here. Carothers' (21) psychographic charts show well the variations in different abilities in the same individual, and her suggestions as to personal interviews with students to discuss the results of the tests are valuable.

Some work has been done in comparing the results of tests with estimates of intelligence. Usually these estimates are the ratings of students by one or more instructors. Some of the results obtained are:

Correlation between Tests and Estimated Intelligence

Author	*Coefficient*
Hollingworth (16)	61
Kitson (17)	57
Uhl (19)	36
Thurstone (19)	60

These coefficients are of much the same magnitude as those between tests and academic grades. Estimates of intelligence, as well as academic grades, are themselves very unreliable and this unreliability tends to lower the correlations. Thurstone (21) says, "I have found that instructors' estimates, on account of their unreliability, are, in general, unsuitable as a criterion by which to judge the predictive value of a mental test. The several instructors' estimates for the same student vary considerably more than the corresponding scholarship grades."

Two studies using the Binet Tests with college students are reported. The number of Binet tests valuable for adults is small. Their wide dissemination among college students makes them of little general value. They do not seem to correlate any higher than the general run of tests. Caldwell (19) reports a correlation of

44 between the Stanford-Binet tests and academic grades. Between the same tests and estimates of intelligence, a correlation of 47 is reported by Caldwell (19), and of 53 by Downey (17). Caldwell finds the I. Q. procedure for adults unsatisfactory and says "there should be some means for denoting higher adult I. Qs." But, surely, it would seem wiser to abandon the I. Q. procedure altogether for adults and particularly for college students.

One of the most extensive surveys of college students is reported by Thurstone (21). His Intelligence Test IV has been given to 6805 Engineering Freshmen, 5495 Liberal Arts Freshmen and to 1575 Normal School Freshmen. Only a preliminary report of these results is at present available. The distribution curves for the engineering and for the liberal arts freshmen are very similar with a slight advantage in favor of the former group. The normal school students fall decidedly below the other two groups. The average score for the normal school students is about 75, while that for the arts students is 87, and for the engineers 89. The distribution tables showing the scores for each college indicate the wide individual variations that exist among the students, as well as the differences that exist among the colleges themselves.

2. *The Army Tests in Colleges.* — The most popular group test for college students up to the present time has been the army test. During and immediately after the war it was given in a great number of colleges. A comparison of the median scores reported for various groups of college students is interesting.[1]

[1] Many of the data presented here are taken from Memoirs of the National Academy of Sciences, Volume XV, 1921.

College	*Median*	*No. of Cases*
Massachusetts Agricultural (men)	150	154
Brown University (men)	142	210
Syracuse University (both sexes)	142	786
Colorado College (men)	142	148
Colorado College (women)	142	178
Rutgers College (men)	138	358
Johns Hopkins (men)	137	140
Notre Dame (men)	137	321
Ohio State University (both sexes)	136	5950
Penn State College (both sexes)	132	847
University of Minnesota (men)	129	534
University of N. Dakota (women)	129	117
University of Minnesota (women)	128	354
Southern Methodist (men)	127	162
University of Idaho (men)	125	277
Southern Methodist (women)	123	159
Colorado Teachers College (women)	122	266
University of Florida (men)	120	215
University of Idaho (women)	117	169
Lincoln Memorial (men)	86	171
Atlanta Southern Dental (men)	80	184
White Officers in the Army	139	15385

This list does not pretend to be exhaustive. Undoubtedly many more groups of college students have been tested and many workers have not published their results. The list, however, gives a fair indication of the results in general. There is naturally some difference in the medians of the various groups. Some of this difference may be due to the composition of the groups, whether made up of freshmen, seniors and the like, or otherwise selected; some of it may be due to a difference in the form of the test used; but some of it is undoubtedly due to the different caliber of the student body found in different colleges. At the bottom of the list is given the median score for officers in the army, showing that the mental rating of officers resembles the rating of college students, as we should expect. The

army test seems to favor men as compared with women. This sex difference has been reported by many workers. Noble and Arps (20) and Hill (19) report sex differences for each college year and in both reports the men exceed the women by a few points at each year. The difference is extremely small but always present. It is very doubtful whether this represents a real sex difference. The general opinion seems to be that some of the tests are more suited to men than to women.

A comparison of the median scores of students in different colleges in a university is given by Noble and Arps (20), and we may compare their results with those reported for a few colleges at the University of Illinois:

	Ohio State		*Illinois*	
	Median	*Cases*	*Median*	*Cases*
Graduates	157	152	154	161
Commerce	147	52	143	539
Medicine	142	141	...	...
Law	142	141	...	...
Engineering	141	1392	144	755
Agriculture	133	859	139	385
Arts	133	1966	145	1410
Education	133	382	...	...
Pharmacy	125	109	...	...
Dentistry	115	152	...	...
Vet. Medicine	112	93	...	...

Both reports place the graduate schools at the top of the lists by a very appreciable margin. There is no agreement between the two reports as to the standing of the four other colleges, where we have comparable data. At Ohio State the professional schools range themselves about equally above and below the median for the Arts College. Undoubtedly there are selective influences at

work in determining the student body of a college and these influences may not be the same at each university. At Ohio State the relatively low standing of the students in Dentistry and Veterinary Medicine corresponds with the low standing of dental and veterinary officers in the army. The medical group, however, is above the engineering group at the university, which was notably not the case in the army.

How do the intelligence ratings on the army tests correlate with the students' work in college as evidenced by his class marks? Numerous correlations are reported:

	Coefficient	*No. of Cases*	*Class*
Bridges (20)	35	436	All classes
	15	36	Graduates
	38	100	Seniors
	35	100	Seniors
	29	100	Juniors
	29	100	Sophomores
Colvin (19)	45	212	Freshmen
Stone (22)	44	633	Freshmen
	33	633	Freshmen
	50	622	Freshmen
Van Wagenen (20)	46	84	Sophomores
	50	84	Sophomores
DeCamp (21)	41	320	Freshmen

These are typical of the results usually obtained in comparing the intelligence ratings with academic grades for all subjects for one or more semesters. The lowest correlation is 15, but this seems to be a decided exception. In general they fluctuate between 30 and 50. If we compare these coefficients with the coefficients for

the miscellaneous groups of tests given on page 267, we note a much greater uniformity in the results from the army tests. In both lists, however, most of the coefficients lie between 30 and 50. The army tests do not seem to correlate more highly than some other groups of tests. They have, however, the advantage over most of the tests previously reported in being easy to give and score and economical in time.

Stone (22) reports coefficients of correlation between the army test and separate freshman subjects. They are all positive and range from .11 to .50. He also attempts an analysis of the different tests of the whole scale, and concludes, "all in all, the present Alpha would, from the standpoint of elective advisory purposes, seem to be as random an agent as the traditional campus method of selecting courses." Davis (21), using the regression equation obtained after correlating the army test with total grades, would make use of it in estimating whether a man is working up to his ability or not, but reports no practical use of this scheme. The most pessimistic attitude with reference to the use of the army tests is expressed by Bridges (22), who summarizes his experience with the work at Ohio State and concludes that the tests at present are of practically no value in university work. Instead of these general group tests, he recommends detailed psychological and psychiatrical examinations of special problem cases. Van Wagenen (20) is much more hopeful as to their possible value in college work. His analysis brings out the fact that "over fifty per cent of the students will not change their standing in academic marks from their standing in the army test by more than one-half sigma unit or by more than one-fifth of the range of the scores

of college students or by more than a change from a D to a C, or from a C to a B, as these marks are given to college students." He feels, however, that the tests "prove least useful just where reliable results from their use are most needed; namely, in eliminating those most likely to fail in their college work and in selecting for special groups those who are most likely to attain the higher degrees of success." And further, "there is yet, however, far too large a discrepancy between the positions attained in the Army Tests and those achieved in academic marks to warrant the use of the Army Tests for purposes of rigid selection." Van Wagenen is hopeful that modifications and changes in the tests may lead to greater predictive value.

This work with the army tests in colleges and universities, although extensive, has been more or less experimental in nature. Unpublished accounts of the work in several universities indicate that practical use is being made of the results to some extent. Men with high intelligence ratings and low college grades are reported to improve frequently when confronted with the facts. Deans and other administrative officers take the intelligence rating into consideration when dealing with academic delinquents and cases of probation, dismissal, reinstatement, petitions to carry extra work and the like. The extent to which students of low intelligence are consuming administrative time and energy is shown by the report from Ohio State, in which 81 per cent of the delinquents in a certain college were found to be students with intelligence scores equal to those received by the lowest 5 per cent of the whole student body.

3. *The Thorndike College Entrance Tests.* — The most significant application of intelligence tests to col-

lege students at present is the use of the Thorndike Tests by the Department of Admissions to Columbia College. The test is very much more comprehensive and much more difficult than the Army Alpha Test. It requires two hours and fifty minutes actual working time, and includes some educational tests of a type suitable for high school graduates. Applicants for admission to Columbia whose school and character records are satisfactory may substitute the psychological examination instead of the usual entrance examinations. A correlation of 65 between the work of the entire freshman year and the scores on the mental test is reported by Thorndike (21). The test is obviously detecting the poorer students, for "of eleven boys at Columbia, reported to the dean's office for inability to do college work in the early weeks of the year, all had notably low scores in the intelligence examination. Of a score or more so reported as a result of the mid-term records, all but two had low scores. The defective college work of these two was by common consent not due to intellectual defect" (Thorndike, 20).

Not only for admission, but also for administrative purposes are the tests proving valuable. Thorndike (21) quotes the Dean of the College as follows:

"In addition to the use of the results of the mental tests in admission to college, they have been most helpful in my office as an aid in arriving at a diagnosis of academic maladies. A boy who has a poor academic record and a low mental test grade generally needs very different treatment from the student whose record is poor but whose mental test mark is high. And in several cases the mental test has afforded the clue which has enabled my office in coöperation with the university

physician so to advise the boy that he has not only escaped being dropped, but has become an excellent academic citizen."

Wood (23), in describing the work at Columbia, says, "In 1919 the office of Admissions of Columbia University inaugurated an experiment for the purpose of discovering the value of the Thorndike College Entrance Intelligence Examination for High School Graduates as a criterion for admission to Columbia College. From an attitude of healthy, if not severe skepticism toward the use of intelligence tests for this purpose, the whole college administration came, within the space of two years, to consider the intelligence tests as an indispensable part, not only of the admission machinery, but also of the administration of the college in the Dean's Office." Wood also gives the correlations between the intelligence scores and scholarship records of 111 students who remained in college during two years:

Freshman Year	$r = .63$
Sophomore Year	$r = .62$
Freshman and Sophomore Years	$r = .67$

That the intelligence test has higher predictive value of a man's work in college is shown by the following correlations with the scholarship record for two years:

	r	*n*
Thorndike Intelligence Test	.67	111
Regents Examinations	.64	144
Secondary School Marks	.26	103

A report of the Thorndike Tests at the University of California is made by Breitwieser (22) in which he gives a correlation of 47 between the test and the aver-

age scholarship grades for the first semester for 273 freshmen. The same report gives interesting comparisons between freshmen in the various colleges, as well as a comparison of the scores for men and women, showing the women a few points below the men.

4. *Conclusions.* — This survey of intelligence testing in colleges and universities shows the widespread use of tests at the present time. A list of 29 institutions who are using or have recently used intelligence tests is given by Whipple (22). By far the most popular test up to the present time has been the Army Alpha, which has been used by 16 of the 29 institutions referred to above. Whipple points out three disadvantages of this test, namely, (1) it has been published in several books and, therefore, can be bought by a student and studied; (2) on the whole, it is somewhat too easy for the average college student; (3) it seems to be better adapted to men than to women. These disadvantages are being overcome by other tests, notably the Thorndike Tests, and in the future, the popularity and use of the Army Alpha is likely to decrease.

As to the practical use of intelligence tests in colleges, we may say that at present the work seems to be largely theoretical and experimental with a few notable exceptions. The amount of practical use of intelligence tests is much less in colleges and universities than we have found to be the case in elementary and high schools. Undoubtedly the practical use will increase as the instruments of measurement become more accurate, and as the skepticism of the faculties is overcome.

Intelligence tests are being used or have been recommended for use in the following different ways:

1. As a means for determining admission to college or university.
2. For the sectioning of large classes into groups of more homogeneous mentality.
3. As helpful in giving educational advice as to the classes a student should select or the number of hours he should carry.
4. As an element in the vocational guidance of students in helping them decide the profession or occupation they should choose.
5. As helpful in leading to a better understanding of the delinquent student or student on probation.
6. To stimulate the brighter student to work up to capacity.
7. To select the brightest students and guide them in their work and choice of a career.

What we have said before with reference to school children applies equally well to college students, namely, that the intelligence rating is only one factor in the total make-up of the individual. Success in college and in after life depends upon much more than merely abstract intelligence as measured by the ordinary group test. What the educational guidance of college men involves is brought out admirably by Colvin (21, 22) in his description of the personnel work at Brown University. In addition to the intelligence tests, information is gathered as to a student's purpose and aim in life, his academic, vocational, non-academic and reading interests, his character qualities, his health, his family, his previous life, and so forth. Interviews at the end of each college year are arranged, in addition to special consultations. The psychological test, therefore, is only one item, although an important item, in the total pro-

cedure. Colvin mentions the following ways in which intelligence tests have been found useful: (1) "They throw some light on the question as to whether a student is better fitted for a professional career or for business pursuits." Men with high intelligence ratings are urged to enter professional work, if their other qualifications are suitable. Society needs high grade men in the professions. (2) The tests indicate to some extent the type of mind that a student possesses. They seem somewhat unfair to men who are plodders, but careful and accurate thinkers. (3) They make possible a distinction between character qualities and mental alertness, e.g., cases of high intelligence ratings and low grades, and vice versa. (4) They throw light on the home environment and educational equipment of the student, especially in the case of those of foreign ancestry. (5) They show the presence or lack of scholarly ambitions and ideals. (6) They show whether it is desirable for a student to continue in college or withdraw. (7) They may serve as an incentive to work up to the level of one's abilities.

We may, therefore, sum up this chapter by saying that the large amount of experimental work in intelligence testing in colleges and universities has made clear the possibilities that lie ahead for this sort of work. Up to the present time, however, only a few of these possibilities have been realized. They will be realized in the near future. Intelligence tests will help to select a better student body, and discover and develop the latent powers that are now often undetected.

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CHAPTER XIII

THE DELINQUENT

Amount of Feeblemindedness. — The problem of the psychological make-up of the offender against society is one that has always attracted the psychologist. It has been felt that in general the criminal or delinquent must differ psychologically from the non-delinquent person, and it was hoped that such difference would help to explain to some extent the nature and causes of delinquency. About the time that intelligence tests were being introduced into this country, the belief in physical differences between the delinquent and non-delinquent, notably the anthropometric measurements of Lombroso and his followers, was on the wane. It was natural, therefore, that intelligence tests should be tried out on delinquent individuals. The first intelligence examinations were made on inmates of institutions for the feebleminded, but the workers in these institutions were naturally interested in the problems of delinquency, because such problems were continually being forced on their attention in connection with the past history of the feebleminded children.

Very early, therefore, in the history of intelligence testing, we find reports of such tests given to delinquents, and the study of the mentality of the delinquent has been extensively pursued ever since. These studies include delinquents of all types, those who are trouble-

some in school, those who are brought before a court, and finally the convicted delinquent detained in a reformatory, industrial school, jail, prison, workhouse or penitentiary.

The outstanding characteristics of the earlier reports was the very large percentage of feeblemindedness found among delinquents. Studies showing 60, 70 and even as high as 90 per cent of delinquents testing feebleminded were reported, and there was a tendency among many to accept these reports at their face value and assume that the all-important and, perhaps, only vital difference between the delinquent and non-delinquent was a difference in general intelligence. A simple solution of the vast mass of delinquency would thus be a more efficient and thorough-going segregation of the feebleminded in the general population. Delinquency, however, is not such a simple matter as to be explained by any one single cause, such as feeblemindedness, alcoholism, poverty, lack of education, or the like. This over-emphasis of the amount of feeblemindedness among delinquents was immediately questioned by many psychologists, and it was rightly pointed out that some of it was due to the faulty construction of the intelligence scales then available. This was notably the case with the Goddard Revision of the Binet Scale, which was much too hard at the upper end. It penalized the older children, those between ages twelve and eighteen, and it is just at these ages that we find most of the delinquents confined in boys' and girls' reformatories.

The amount of estimated feeblemindedness among delinquents can best be appreciated from a study of Tables IV and V. In these tables some of the investigations have been recorded. In most of the cases the

TABLE IV — DELINQUENT CHILDREN

Author	*No. of Cases*		*Per Cent F.*	*M.*
Hill & Goddard .....(11)	56		93	
Gifford & Goddard .....(12)	100		66	
Bridgman .....(13)	118		89	
Otis .....(13)	172		75	
Pintner .....(14)	100		46	
Pyle .....(14)	240		66	
Bronner .....(14)	505		9–11	
Williams .....(15)	400		36	
Hickman .....(15)	229		75	
Haines .....(15)	200		62	
Williams .....(15)	150		28	
Haines .....(15) (16)	1000		24–29	
Kohs .....(15)	335		65	
Crane .....(15)	809	(boys)	39	
	386	(girls)	72	
Healy & Bronner .....(16)	2000		11	
Ordahl .....(16)	341		40	
Fernald .....(16)	124		20–24	
Bowler .....(17)	75		45	
Hall .....(17)	607		35	
Kelley .....(17)	296		20	
Ordahl .....(17)	33		45	
Faber & Ritter .....(17)	110		14	
Bridgman .....(18)	205		36	
Whittier School Report (18)	251		30	
Ordahl & Ordahl .....(18)	432		23	
Miner .....(18)	123		7	
Henry .....(21)	50		34	
Richmond .....(21)	38		16	
Anderson .....(21)	311		21	
Mateer .....(21)	553		45	
Healy .....(22)	1212		7	

writers used the Binet Scale in some form or other, although in some of the later reports group intelligence

TABLE V — DELINQUENT ADULTS

Author	*No. of Cases*	*Per Cent F. M.*	*Type of Institution*
Rowland .....(13)	35	31	State Reformatory for Women.
Mass. Report ..(14)	289	51	Prisons and Industrial Schools.
Spaulding .....(15)	400	44	Prison.
Rossy .....(15)	300	22	State Prison.
McCord .....(15)	50	54	Prostitutes at large.
Weidensall ....(16)	88	40	Reformatory.
Fernald .....(17)	100	41	Reformatory.
Haines .....(17)	100	20	Penitentiary.
Gilliland .....(17)	100	33	Workhouse.
Pintner and Toops .....(17)	132	29	Workhouse.
Ordahl and Ordahl .....(17)	49	29	Penitentiary.
Terman and Knollin .....(18)	155	17	Penitentiary.
Doll .....(19)	50	16	State Prison.

tests were used. The reports are listed in chronological order and glancing down the column it can be seen that, in general, there is a tendency to become slightly more conservative as to the percentage of feeblemindedness in the later reports. The amount of feeblemindedness among children is in general greater than that among adults. The median of the percentages of feeblemindedness for the children's reports is 36 and for the adults 31. By taking the median percentage of the earlier reports and the median of the later reports, we obtain some measure of the trend of opinion during the decade in question. For the children, the median of the first

16 percentages is 64, and of the last 16 percentages the median is 26. For the adult, the median of the six earlier reports is 42, and for the seven later ones 29. The sweeping statements of the first mental examiners that 70 or 80 per cent of all delinquents are feebleminded is reduced to 20 or 30 in later reports, and the most conservative workers would put the percentage still lower. Miner's (18) careful analysis of the general results and his own personal studies lead him to this conclusion: "I see nothing in the present evidence from mental tests to indicate that the frequency of mental deficients who might justly be sent to institutions from among the ordinary children who come before the juvenile courts of the country, would be over 10 per cent."

The variation of the percentages listed in Tables IV and V is not by any means wholly due to the difference in examiners' opinions as to who should or should not be diagnosed as feebleminded. Much of it is due to the difference in the mental make-up of the groups examined. Included in the groups examined are delinquent and troublesome children in the public schools, children brought before the Juvenile Court, children convicted by the Court, children confined in various correctional institutions, individuals confined in prisons and penitentiaries, as well as one or two groups of recidivists. In general it has been found that the percentage of feeblemindedness increases as we go from the unconvicted to the convicted delinquents. The feebleminded individual is more likely to be caught and convicted than is the individual possessing a greater amount of intelligence. In the same way the individual with several convictions against him is on the average less intelligent than the individual with only one.

The general survey given above represents very well the conflicting opinions among the workers as to the amount of feeblemindedness among delinquents. Practically all of them would agree that the average delinquent is mentally below the average non-delinquent, although they would differ as to the amount.

Recent Surveys. — There are two or three recent studies which suggest that there is still less difference between the delinquent and non-delinquent than even the most conservative of the reports mentioned above. These studies are surveys of correctional institutions made by means of the army group tests, and the results seem to show that the distribution of intelligence ratings of the delinquents is practically the same as that of the drafted men in the army.

Doll reports the results of the Army Alpha tests on 839 prisoners in the New Jersey State Prison. He compares their scores with the scores obtained from 6541 white draft recruits at Camp Dix, New Jersey. The average score for the prisoners is only slightly below the average of recruits at Camp Dix.

The reason for this discrepancy is the excessive number of negroes and foreigners in the prison group. He has eliminated the negroes in the army draft data. He, therefore, concludes — " In general, then, it may be said that when allowance is made for selective influences on the basis of nationality and color, the mental constitution of the prison, as a whole, corresponds very closely to the average intelligence of adult males of the state as a whole." Only a small percentage of prisoners (7 per cent) obtained scores equivalent to those of army officers as compared with the recruits (13 per cent). Superior intelligence would, then, seem to be less frequent among prisoners than in the general population.

Anderson's (21) data would seem to confirm Doll's findings, and they are interesting inasmuch as they are based upon younger delinquents between the ages of eight and nineteen. This fact is of importance because of the general belief in the greater incidence of feeblemindedness among juvenile as compared with adult delinquents. The distribution of the 197 girls as given by Anderson is as follows:

Rating	*Classification*	*Per Cent Delinquents*	*Per Cent 94,004 Drafted men*
A	Very Superior	0.5	4.1
B	Superior	3.0	8.0
C +	High Average	14.7	15.2
C	Average	25.4	25.0
C —	Low Average	26.9	23.8
D	Inferior	17.3	17.0
D —	Very Inferior	12.2	7.1

The distribution for the delinquents is very much like the distribution for the drafted men, with the exception of a slightly larger percentage of very inferior, and a smaller percentage of superior. The percentage of delinquents rated A and B totals 3.5 as compared with 12.1 for the drafted men. If we consider all testing D— as feebleminded, we have a percentage of 12.2 feebleminded. On the basis of the Yerkes-Bridges Scale, Anderson in the same article reports 20.9 per cent feebleminded. This large discrepancy suggests that much higher standards are being used for the individual than for the group tests.

Data gathered on delinquent soldiers (Memoirs 21) show on the one hand a distribution for Fort Leavenworth prisoners very similar to the general distribution of the white draft, while for prisoners in guard houses

in various camps a large percentage of men of inferior intelligence. The percentage distribution of these two groups compared with the white draft is as follows:

	E, D—	D	C—	C	C+	B	A	Total
Leavenworth Prisoners	6.0	18.8	20.8	23.8	16.0	8.8	5.8	3,368
White Draft	7.1	17.0	23.8	25.0	15.2	8.0	4.1	94,004
Guard House Prisoners	20.6	25.5	21.6	18.9	8.3	3.4	2.1	1,004

The prisoners at Leavenworth were convicted on serious charges, while those in camp were convicted on minor charges. Low intelligence would seem to be a factor in less serious delinquencies. About 300 of the Leavenworth prisoners were conscientious objectors on religious or political grounds. The results show this group superior in intelligence to the white draft. Hence, to some extent the group at Leavenworth is not representative of prisoners in general.

These recent studies of the intelligence of delinquents as compared with the intelligence of the drafted men in the army seem to indicate that we may have to revise still further our conception as to the amount of feeblemindedness among delinquents. Our estimate as to the general intelligence of the population at large has evidently been too high. As this estimate has decreased in amount, the difference between the intelligence of the delinquent and non-delinquent groups has diminished.

More Elaborate Studies. — In addition to the studies just mentioned, we have two important ones that are worthy of notice, namely, the statistical study of Goring (13) on the English convict, and the elaborate study of Fernald, Hayes and Dawley (20) on the female delinquent.

Goring's study is mainly anthropometrical and is directed against the opinions of the school of Lombroso and the belief in physical differences between the criminal and non-criminal groups. Exact measurements of a great many physical characteristics were made on a random sample of 3000 English convicts. These results have no direct bearing upon our study of the intelligence of the delinquent, but Goring's main conclusions are worthy of note in passing. "We conclude that criminals are not physically differentiated because they are criminals, but because of differences in age, stature, intelligence, etc., etc., and of the different social classes from which they are drawn." After comparing criminal and non-criminal groups, he says, "our inevitable conclusion must be that there is no such thing as a physical criminal type." All the differences between criminals and non-criminals disappear when we equate for differences in stature and age. Criminals do differ from the general population in being somewhat shorter (average two inches) and slightly lighter. "These are the sole facts at the basis of criminal anthropology."

As to the mental differentiation of the criminal and non-criminal, Goring's study is of interest, although we feel that it suffers much from the fact that no objective tests were used. The men were classified into five groups: (1) intelligent; (2) fairly intelligent; (3) unintelligent; (4) weakminded; (5) imbecile, upon the subjective opinion of the prison physician. Comparing the results of this classification with the British Royal Commission's estimate of 0.46 per cent feebleminded in the general population, Goring estimates the amount of feeblemindedness in the prison population as ranging from a minimum of 10 per cent to a maximum of 20

per cent. Taking the latter figure, he finds a coefficient of association between lack of intelligence and crime of .79, and concludes that "defective intelligence is one of the primal sources of crime in this country." He further remarks, "but probably the chief source of the high degree of relationship between weak-mindedness and crime resides in the fact that the criminal thing which we call criminality, and which leads to the perpetration of many, if not of most, anti-social offenses today, is not inherent wickedness, but natural stupidity." It is this native lack of intelligence, rather than environmental factors, that is a cause of crime, for "crime in this country is only to a trifling extent (if to any) the product of social inequality, of adverse environment, or of other manifestations of what may be comprehensively termed the force of circumstances." Finally, his general conclusion on physical and mental differences is, "that the one significant physical association with criminality is a generally defective physique; and that the one vital mental constitutional factor in the etiology of crime is defective intelligence."

We have quoted at length from Goring because of the exactness and care of the author, the wide range of the study and the importance of his final conclusions. Equally exact and careful is the work of Fernald, Hayes and Dawley (20) on women delinquents in this country. It differs from Goring's study in that estimates of intelligence were based upon mental tests. The Binet, Yerkes, Stanford and Woolley Scales were used as well as a group of performance tests. An elaborate social study was made of each case. The measurement of the intelligence of the cases is unquestionably much more accurate than Goring's measurement, based on subjec-

tive opinion. No percentage of feeblemindedness is given with which to compare Goring's estimate of 10 to 20 per cent. The average mental age of 447 delinquents is 11.8 as compared with an average M. A. of 13.4 for an unselected group of 653 army adults. The overlapping of the delinquent and non-delinquent groups is very great, and the data indicate a slighter degree of difference than Goring's data indicate. Furthermore, the writers are inclined to stress the importance of "the force of circumstances" in their final conclusions in which they mention "two lines of influence which seem to have a bearing on the problem of delinquency among women, namely: (1) poor economic background with few advantages or opportunities, and (2) a somewhat inferior mentality." And again, "We disagree with Goring in the preëminence attached to such a constitutional factor as defective intelligence in contrast with economic factors."

These two detailed and careful studies both agree in finding the delinquent less intelligent than the non-delinquent, but differ as to the amount. It is interesting to note that the study based upon objective tests is the one that finds less feeblemindedness. On the other hand, Goring's subjective estimates undoubtedly include cases of mental derangement and possible character deficiencies which might not be included in those cases in the other study testing mentally deficient, and this may account for some of the difference. The radical difference between the two studies is the contrasting emphasis placed upon the influence of environmental factors. It is a difference that is frequently met with in the interpretation of psychological and social data, and in general, the tendency of the psychologist is to emphasize

the importance of original nature as opposed to environmental factors.

Superior Intelligence and Delinquency

So far all studies have agreed in reporting a much smaller percentage of superior intelligence among delinquents than is supposed to occur in random non-delinquent groups. Even in the studies of Doll and Anderson by means of group tests where the difference between the delinquent and non-delinquent groups was small, what difference there was depended mainly on the discrepancy at the upper end of the distribution. Either the percentage of superior delinquents is very small, or else, and this is most often the case, the investigator has been mainly concerned with discovering the mentally deficient and has included the superior among those who are not deficient or among those who test normal or above. It is, therefore, impossible to say what percentage of delinquents have superior intelligence, and our best opinion would be that this percentage is very small as compared with the percentage of those having superior intelligence among the non-delinquents, whatever may be our line of demarcation between average and superior intelligence.

Williams (16) has discussed this problem and finds that of 300 delinquent boys only 20, or $6\frac{1}{2}$ per cent, had an I. Q. of 102 or above, as compared with Terman's estimate of 48 per cent for unselected school children. If, however, we define superiority as meaning an I. Q. above 110, we find only three of the 300 delinquent boys in the really superior group. This is one per cent. The group test results of Anderson and Doll previously men-

tioned report 3.5 and 7 per cent superior. Healy (22) reports 8 per cent having I. Qs. of 110 or above on the Stanford Scale.

It would be interesting to have other and more detailed studies of those of superior intelligence among delinquents. The popular opinion that a large number of criminals are individuals of great ability and intelligence, and that a great many crimes give evidence of having been conceived and executed by people of superior intelligence is certainly not confirmed by the results of intelligence testing.

Sex Differences. — Several writers have commented upon a probable sex difference among delinquents with regard to intelligence. Comparing similar institutions for men and women, it is generally found that the average mentality of the females is less than that of the males. Taking also into consideration the well known fact that there is a much greater proportion of delinquent males than females, and that courts and juries are more reluctant to convict the female offender than the male, because of the greater opprobrium which thereby rests upon the girl or woman, it is not surprising that institutions for female offenders should show a larger percentage of feeblemindedness than similar institutions for male offenders. The female offender, more particularly the girl, comes to the institution with a longer record of delinquency behind her than the boy. She has been given more chances; she is put on probation more frequently by the court; so that among those who fail to make good, we are in the long run, more likely to find a large proportion of feebleminded girls.

Type of Crime. — The relation between intelligence and the various types of delinquency has been studied

by many investigators. Nothing very definite has so far resulted. Almost every type of crime or misdemeanor seems to be represented by all grades of intelligence. There is, however, a tendency for vagrancy, drunkenness, assault and battery, begging, and the like, to show a lower average mental age than forgery, embezzlement, and allied crimes. Burglary, larceny, thieving, and the like, are represented by all grades of intelligence, and this is also the case with homicide. Particularly brutal murders seem often to be committed by feebleminded, epileptic or insane individuals. Women and girls convicted of sexual immorality in general test lower than those convicted of other offenses. Most investigators seem to agree that truancy among school children is closely related to delinquency. This relationship between truancy and delinquency has been discussed by Abbot and Breckenridge, who report that 40 per cent of 456 truants were not normal mentally. Further, Doll (21) is of the opinion that a large proportion, probably about two-thirds of juvenile delinquency, is traceable to truancy. The juvenile delinquent very often starts his career by being a truant, although, of course, it does not follow that all truants later on become delinquents. Obviously truancy is a symptom of some sort of maladjustment between the child and the school. The inability of the child to adjust himself adequately to the school environment may later on show itself in inability to adjust himself to his out-of-school environment, and so lead directly to anti-social conduct.

Future Success of Delinquents. — If the modern justification for our correctional institutions is the reformation of the delinquent, then the after-success of the in-

mate will be a measure of the efficiency of our system. To what extent this is true is unknown, as there are few, if any, satisfactory studies of this large and important problem. Only one aspect of the problem, however, concerns us here, namely, the relationship between the after-success of the delinquent and his intelligence.

There are few studies of this problem, largely because of the difficulty of getting adequate data, and also because of the difficulty of measuring after-success. Pintner and Reamer (18) tried to estimate the after-success of 26 delinquent girls ranging in C. M. A. from 70 to 109. The correlation between intelligence and their success, as estimated by the combined judgment of three observers, was +.16. They conclude that the mental tests are not prognostic of after-success. Further, they say, that those of poor intelligence seem just as likely to make good as those of normal intelligence. Clark (20) in a more detailed report of 223 delinquent boys concludes that " there is a distinct tendency for the boys of higher intelligence to have a better record of success than those of lower mentality." He divides the cases into six industrial groups and finds radical differences in the correlations between intelligence and success in these various groups. The coefficients range from +.74 for the agriculture, forestry and animal husbandry group to —.51 for the transportation group. In general, he finds that " a positive general relationship between intelligence and success record for the whole group was indicated by a coefficient of correlation of +.19." Note that this is about the same as that reported by Pintner and Reamer.

Other Factors Besides Intelligence. — It is the main

purpose of this chapter to show the results of the intelligence testing of delinquents. This we have attempted to do. We cannot, however, refrain from mentioning other mental factors that are of undoubted importance in the study of delinquency, so that we may not lose sight of the fact that the problem of adequately understanding the delinquent is a much broader one than that of merely obtaining a measure of his intelligence. A study of moral and character qualities has been urged by Healy, Bronner, Kohs and others. Healy (15, 17) has been very insistent upon a thorough study of the whole personality of the delinquent in which the intelligence rating is only one item. The individual case studies of Healy and Bronner (22) are models of excellence for this type of approach. He has further shown the importance of mental analysis and indicated the frequency of mental conflicts as causative factors. The work of Goddard (21) at the Ohio Bureau of Juvenile Research has stressed greatly the importance of other mental abnormalities in addition to intelligence defect. He believes that a great number of delinquents are psychopathic, while, at the same time, they may or may not be of inferior intelligence. Bronner (14) has attempted to get some measure of the moral nature of the delinquent by means of an objective test and Kohs (22) has given us the first comprehensive test of ethical discrimination. This test follows more or less the technique of the group intelligence test, but the main emphasis is upon knowledge of ethical values. Work of this type is bound to increase in the future and will undoubtedly extend our knowledge of the delinquent very materially. It will raise the question of moral deficiency and the extent to which this is related to in-

telligence defect. This approach to the study of delinquency is of unquestionable value, and the amount of space we have given it in this chapter is not to be interpreted as our estimate of its importance. The main topic of our whole book is the measure of intelligence so that we merely mention these other approaches to the study of delinquency in order to remind the reader that the question of the intelligence of the delinquent is by no means the only one of importance.

Conclusions. — The problem of the intelligence of the delinquent is obviously one that has undergone marked changes during the last decade in which it has been vigorously attacked by means of intelligence tests. From a belief in a very large percentage of defective mentality among delinquents, we have come to suspect that this percentage is only about ten or fifteen, with some workers intimating that it may not differ from the percentage of feeblemindedness found in the general population. Nevertheless, most workers feel that the one most common factor associated with delinquency in general is defective mentality, and that, therefore, practical effort to understand, educate and segregate the feebleminded is of great importance in the solution of the problem of delinquency, even although such efforts cannot be expected to diminish radically the number of delinquents with which society has to deal.

As the emphasis upon defective mentality has decreased, there seems to be arising an attempt to find the difference between the delinquent and non-delinquent in other mental factors. Psychopathic disturbances, character and moral defects are hinted at as being of great importance to our problem, and in line with this thought we note the attempt to measure such factors objectively.

Undoubtedly, in the near future, many scales of these factors will appear.

As to the importance of environmental factors, there seems to be the usual difference of opinion, but the general belief of the psychologist seems to be in the greater potency of original nature and he is inclined to see in many environmental features the results of original nature in the first instance. Poverty, alcoholism, lack of education, and the like, are all to some extent, the results of defective mentality and cannot be considered the sole or primary causes of anti-social conduct.

All reports so far have agreed in finding a much smaller percentage of delinquents of superior intelligence as compared with the amount of superior intelligence supposed to exist in the population at large. Also, there seems to be agreement in the finding of a larger proportion of defective delinquents among female as opposed to male delinquents. The type of crime a delinquent commits has evidently some relation to his intelligence, but it is difficult to disentangle this one factor from all the others that are at work leading to the commitment of different sorts of crime. And, finally, the future success of a delinquent in the world is evidently conditioned by so many factors, other than intelligence, that we have not found, up to the present time, that the intelligence rating is at all prognostic of future success.

All these conclusions impress upon us the fact that the problem of delinquency is a very intricate one, and a very broad one. An individual may become delinquent through one of a great many causes. Other things being equal, however, an individual of defective mentality is more likely to become delinquent than one of normal or superior mentality.

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CHAPTER XIV

THE DEPENDENT

Dependency is a very broad term and is often used to cover all those cases in which families or individuals are not self-supporting. Used in this broad manner, it would include not only the ordinary cases dependent upon public or private charitable agencies, but also those in institutions of various kinds such as feebleminded institutions, hospitals of various kinds, schools for the deaf, blind, cripples, and the like, and perhaps prisons and reformatories. In a narrower sense, however, the term is frequently used for individuals who are helped or supported by charitable agencies, such as children's homes, orphan asylums, almshouses, county infirmaries, and local charity organizations, to the exclusion of those afflicted with special disabilities, such as blindness, deafness, tuberculosis, and the like, as well as those convicted of delinquency. It is in this narrower sense that we shall use the term "dependent" in this chapter.

Almost all the intelligence testing of dependents has been confined to dependent children. We have very little direct knowledge of the mentality of the dependent adult. Most of the children tested have been those cared for by orphan asylums or children's homes. It is worth remembering in passing that the term "orphan" as applied to such children is very misleading. "Orphan" means strictly a child, both of whose parents are dead.

TABLE VI — DEPENDENT CHILDREN

Author	No. Examined	F. M.	Backward	Normal	Above Normal	Institution
Stenquist and others.....(15)	256	18.5	62.0	19.0	0.5	County Homes
Pintner.....(17)	106	5.7	46.2	34.9	13.2	A County Home
Hall.....(17)	2142	6.7	....	....	....	23 Child-Caring Institutions
Williams.....(18)	150	6.0	32.5	49.5	12.0	4 Homes for Children
Carlisle.....(18)	141	7.8	....	....	....	Orphan Asylum
Carlisle.....(18)	117	9.4	....	....	....	House of Good Shepherd
Terman and Wagner.....(18)	68	6.0	29.0	53.0	12.0	Orphan Asylum
Haines.....(19)	270	17.0	....	....	....	Orphanages
Mateer.....(21)	1603	33.7	3.9	13.8	0.6	34 County Homes [1]
Pintner.....(17)	82	19.5	39.0	36.6	....	Selected Clinic Group [2]
Bridgman.....(18)	133	26.0	40.0	34.0	....	Selected Clinic Group

Dependent Adults

Crane (15) 3334 cases in 79 county infirmaries interviewed and 21 per cent were estimated to be feebleminded.

Brigger (16) 25 repeaters at the Associated Charities tested and 24 per cent diagnosed as feebleminded.

Haines (19) 385 inmates of county poor farms examined and 36.6 per cent diagnosed as feebleminded.

[1] In addition there are 46.8 per cent of the cases diagnosed as potentially feebleminded or else "deferred diagnosis."

[2] In addition 4.9 per cent diagnosed as doubtful.

As a matter of fact only a small percentage of the cases in these homes are orphans in the strict meaning of the term. A great many have one parent living and a still greater number have both parents living. The presence of the children in a home indicates, therefore, a breakdown on the part of the family either because of some unfortunate accident to the breadwinner or else because of the incapacity of the breadwinner to support himself and family. The very fact that so many of the children have both parents living would lead one to suspect that in some cases the trouble is simply intelligence defect on the part of one or both parents, leading to an inability to compete with others in the ordinary course of life. This might lead us to suspect, therefore, a greater amount of feeblemindedness among such children than would be found in unselected school children.

Table VI gives a summary of most of the studies available in which mental tests have been used. The first nine studies are all concerned with children in so-called orphan asylums or county homes. The next two deal with dependent children referred to clinics by charitable agencies, and therefore, represent more selected groups. Under dependent adults we have two studies of county infirmaries and one of adults aided by the associated charities.

Considering the first nine reports of children, we note that the percentage of feeblemindedness varies from six to thirty-four per cent with a median of about eight per cent. This median of eight is much lower than the median percentage for delinquents which we noted in the previous chapter. The percentage of seventeen reported by Haines (19) may be partially due to the fact that Mississippi has no special institution for the care

of the feebleminded. The high percentage of thirty-four reported by Mateer (21) is in decided conflict with all the other reports, and must be due to some radically different method of diagnosing feeblemindedness. In general, therefore, we may conclude that the amount of feeblemindedness among dependent children is less than that found among delinquent children, but still much greater than that generally assumed to exist among unselected school children. Furthermore, if the more recent suggestions that we have noted in the previous chapter with reference to the amount of feeblemindedness among delinquents were to be applied in the same way to the dependents, we would find in all probability that the percentage of feeblemindedness would be still further reduced.

When we examine the percentage of dependent children diagnosed as "backward," we note that, wherever figures are given, there is a very large percentage in this group. Poor mentality, even although it may not amount to actual feeblemindedness, would seem, therefore, to be a characteristic of this type of child. Again we find a fair proportion of children rated "above normal." Although our data here are not very adequate, it is interesting to notice that such cases were very seldom reported for delinquent children. It would seem, therefore, that our chances of finding superior children among dependents are much greater than among delinquents. And this would be reasonable, because there are many accidental causes which may lead to dependency in children, who come from a stock possessing good intelligence traits.

The two reports by Pintner (17) and Bridgman (18) of special cases sent to a clinic for examination show

a much larger percentage of feeblemindedness than is found in orphan asylums in general. They are obviously cases that have been referred for examination because of suspected defect or because they were problem cases in some form or other.

The reports of dependent adults show a larger proportion of feebleminded than the children's reports, but from this we can draw no conclusion as to the relative amount of mental defect among dependent adults and children. The cases reported by Crane (15) are infirmary cases and represent the most extreme cases of dependency. Furthermore, the study was made relatively early, and later and more conservative methods of diagnosis might lead to a reduction of the percentage for almshouses in general. The percentage of feebleminded found by Haines (19) in the poor-farms of Mississippi is very large, and a partial explanation of this is that Mississippi at the time of the survey made no special provision for feebleminded individuals. The other report by Brigger (16) represents cases of more or less chronic dependency helped by a charitable organization, and this represents a very selected group of dependent adults. We would expect to find the incidence of feeblemindedness rather high in such a group, but again, later and more conservative methods of diagnosis might decrease the amount. We have no study, so far as the writer is aware, of the intelligence of the general run of dependent adults, such as are dependent upon the more or less regular assistance of our local charity organizations. We can only infer from the studies of the difference in intelligence between children of different social groups, and from the results for dependent children, that the percentage of defectives would be some-

what larger for the dependent adult than is to be found in the general population.

Dependency and delinquency are closely connected. The overlapping between the two groups is great. One common factor would seem to be a somewhat defective mentality. Poverty and neglect are associated with defective mentality. The combination of poverty and lack of intelligence is frequently met with in delinquency. It would, therefore, seem to be wise to examine thoroughly the intelligence of dependent children and make adequate provision for the mentally deficient in order, as far as possible, to forestall the delinquency that will probably result. And, further, because there seems to be a certain percentage of superior children among the dependent cases, it would be wise and just to make adequate provision for such cases, so that they might have opportunities for education and advancement in proportion to their intellectual capacity.

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CHAPTER XV

THE DEAF

The Extent of the Problem. — The handicap of deafness is such as to make a deaf person, particularly if uneducated, very different from a normal hearing individual. Deafness isolates him very much from the world in general, because he lacks the easy and quick method of communication between man and man afforded by speech. The deaf have, thus, always been looked upon as peculiar. Their general lack of speech is called "dumbness" and in American slang the words "dumb" and "dummie" have acquired meanings which have obviously arisen because of the difficulty which the deaf experience in understanding the ordinary speech of their fellow-men. Again, the deaf are relatively few in number. This also has led to the general misunderstanding of them which exists among hearing individuals, and has intensified their isolation. If their numbers were much greater, the chances for the hearing individual to meet and learn to understand them would be more numerous. The 1910 Census (18) gives the total number of "deaf and dumb population in the United States" as 44,708, or about .05 per cent of the total population. Advance sheets of the 1920 Census show a total of 44,885. This makes the problem of the deaf in regard to numbers at least a relatively minor one and explains why they are for the most part misunderstood by the population at

large. Best's (14) analysis of the problem leads him to believe that the number of deaf in this country is decreasing, although very gradually.

Of the 44 thousand deaf listed by the Census, nineteen thousand replied to questionnaires, showing 39.3 per cent in which deafness was congenital (i.e., existing at birth) and 60.7 per cent acquired after birth. The percentage of acquired deafness is undoubtedly exaggerated because of the difficulty of determining whether a child can hear shortly after birth and the general tendency to believe that deafness begins when the family first notices something peculiar about the child with reference to his inability to speak after the first twelve months or so. An analysis of seventeen thousand cases shows about 24 per cent reporting speech used as a means of communication, and 72 per cent not using speech as a means of communication. The number of deaf children in schools is given by Hall (21) as 13,779, the greater proportion or 80 per cent of which are in public residential schools.

Study of the Deaf. — The deaf have for a long time been studied by scientists and educators. For the most part, however, this study has been concentrated upon two types of problems, namely, the medical and the instructional. Under the medical we include investigations as to the causes and possible cure of deafness, and under the instructional the methods of teaching the deaf. Very little psychological work has been done and only within recent years have psychological tests been given.

The history of the education of the deaf is fascinating and in some respects dramatic. Best (14) gives a good account of it and Jones (17) outlines the work in America during the past one hundred years from the time

of the opening of the first public residential school for the deaf in 1817, while Fay (93) gives a detailed history of all the American schools. The absorbing interest of the educators of the deaf during the past century has been the question of methods of instruction, and more particularly what means of communication between themselves and their hearing fellows the deaf should be taught to use. At times this question of means of communication has usurped the stage so completely as to crowd out all the other important problems. Indeed, the outside observer, at all inclined to be facetious, might well remark that the educators of the deaf did not seem to care what the deaf learned but were very much concerned how they learned it, whether by oral or manual methods. The fight between the oralists, who advocate the teaching of speech and lip-reading, and the manualists, who advocate signs and finger-spelling, has absorbed much of the energy of the teachers of the deaf and, perhaps, diverted their attention from other equally important matters. At the present time a great majority of the deaf are taught some speech and lip reading, whether supplemented or not by a knowledge of signs and finger-spelling.

Earlier Psychological Studies. — A detailed account of the earlier psychological studies is given by Reamer (21) and by Pintner and Paterson (17). Here we may simply note that they were concerned with such miscellaneous topics as brain defects and the so-called speech center, the need for classification of deaf children, the problem of the feebleminded deaf child, the peculiar deaf child, the spelling ability of the deaf, anthropometric measurements, memory, drawing ability and the like. Few of the studies were extensive or even

scientific. The work of Love (96 and 12) is mainly medical in character, but he speculates upon the mental characteristics of deaf children. The head measurements are smaller than the hearing — "due to neglect during the period of language formation"! He says, "absence or great defect of hearing arrests mental progress. . . . the physical counterpart of this intellectual basis is that the deaf child at 7 years has a smaller brain than the hearing child of the same age," and again, "the absence of hearing, on which thought processes so much depend, finds no adequate compensation by increased activity of the other senses." All of this is very speculative and very questionable, particularly without adequate psychological tests.

The nearest approach to anything resembling intelligence tests seems to be the tests described by Greenberger (89) for finding out whether the child entering an institution was of fair mentality or not. He suggests that the child be shown attractive picture books and that the examiner watch what the child does. If the child remains perfectly apathetic, it is a bad sign; but if he brightens up at the sight of the books and maintains an interest in them for a period of time, it is an indication of fair mentality that can be improved by training. This is in no sense a test in the modern meaning of the term, but the idea was there, and unfortunately was not further developed. The application of psychological tests proper had to wait for the coming of the psychologist. Macmillan and Bruner (06) seem to have been the first psychologists to apply mental tests. They used the well-known cancellation of "A's" test, perception of size by sense of touch, sensitivity for lifted weights, a few memory tests as well as physical

and sensory-motor tests. In the tests of so-called higher mental functions, they found the deaf to be generally inferior. They suggest that, "this inferiority of the deaf on the mental side perhaps means no more than that the child is from three to four years less mature than the hearing child of his age, and that his date of maturity will be correspondingly delayed." This conclusion is very much open to question and in the light of the results to be mentioned later seems very doubtful. In all probability the average deaf adult remains somewhat inferior to the average hearing individual, regardless of age.

Pintner and Paterson (15) seem to have been the first to apply well-recognized intelligence tests or scales to deaf children. They applied the Goddard Revision of the Binet Scale to 22 deaf children. Various methods of communicating with the children were tried, namely, writing, speech, manual spelling and signs or any mixture of these. As a result of this experiment, they concluded that this type of intelligence scale was totally unsuited for the testing of a deaf child. The results showed the deaf child on an average to be four and one-half years retarded. The inadequacy of language tests as tests of intelligence for the deaf is, however, the vital point that is brought out by the study, and it was this work with the deaf that stimulated them to construct their Performance Scale.

Comparison of Intelligence of Deaf and Hearing. — When we make such a comparison we must be careful to exclude all tests in which language is involved, whether in the directions to the subject or in the test material itself. Language in the hearing child we regard as a medium through which we may probe into

his mental make-up. Although opportunities for acquiring language may vary greatly from individual to individual among hearing children, yet there is enough in common to make it a basis for intelligence testing. Opportunity for hearing language, and later on for reading, is so widespread that slowness or disability in language is itself indicative of mental inferiority. Not so with the deaf child. For him, the English language is a subject of instruction in the school and his progress in it is painfully slow. A test involving language immediately becomes for the deaf a subject-matter test depending very much upon the amount and length of schooling, the effectiveness of the schooling, and the like. Of course, it is indirectly, like all subject-matter tests, also a test of intelligence and can be so used whenever we have children of equal amounts of schooling, as is the case with educational tests among the hearing. When, however, we want to measure the intelligence of deaf children of different ages and with different amounts of educational opportunity, we must go back of our language tests to something more common to deaf children in general. Hence the necessity for using non-verbal or performance tests.

Pintner and Paterson (15 and 16) and Reamer (21) compare the deaf and hearing on non-verbal group tests. The deaf fall decidedly below the norms for the hearing in all cases. With about 1000 cases on the Digit-Symbol and Symbol-Digit Tests, the percentage of deaf boys reaching or exceeding Pyle's median for hearing boys is 24 and 31 per cent respectively; for deaf girls as compared with hearing girls 10 per cent for both tests. Pintner and Paterson conclude that on the whole the deaf child is about 3 years behind the hearing on these

two tests. This amount of retardation need not be found in every school. This is shown by Newlee (19) who repeated the tests mentioned above with 85 deaf children in a day school and found them about up to the norms for the hearing. We should expect to find differences in intelligence among groups of deaf children just as we find them among groups of hearing children. The Pintner-Paterson group of 1000 cases is a much more representative sampling of deaf children in general than the small select group of Newlee.

Reamer (21) used a much more comprehensive nonverbal intelligence test. At all ages, where representative groups of deaf and hearing children could be compared, the deaf are much below the hearing. The conservative conclusion is that the deaf are about two years behind the hearing and, if the younger children are omitted as being more highly selected among the deaf, we have a retardation of two and a half years. Further, in all comparisons of deaf and hearing in the tests of the Pintner-Paterson Performance Scale[1] the deaf fall below the hearing. In such a special ability as visual memory for digits, the deaf are greatly inferior to the hearing (Pintner and Paterson 17), showing no compensation in this ability for their lack of hearing. We may conclude, therefore, that, so far as the psychologist can measure intelligence at the present time, the deaf as a group are distinctly inferior to the hearing. What percentage of the deaf are technically feebleminded it is difficult to say. Undoubtedly the percentage will be greater than among the hearing.

Mentality of Acquired and Congenital. — The same authors quoted above (Reamer, Pintner and Paterson),

[1] From an unpublished manuscript of the authors.

give comparisons between those children who are born deaf and those who become deaf after birth. Taken as groups, they show no difference in their average general intelligence. Again, comparing the children who become deaf at different ages from birth onwards, there seems to be no real differences in intelligence between the different age groups.

Orally and Manually Taught Pupils. — The comparison of the intelligence of deaf children taught by the oral method with those taught by the manual method shows a decided superiority of the orally taught pupils. This is obviously due to the selective policy of the schools, by means of which the brighter children are generally chosen for oral work. In combined schools (i.e., schools which teach by both methods) all children are generally taught by the oral method at first and those who fail to succeed are relegated to the manual classes. Reamer's median mental index for 1753 oral pupils is 51 and for 211 manual pupils only 43. The method of instruction has, of course, no influence on the intelligence of the two groups.

As to the value of the oral method as a practical means of communication for deaf children, none of these psychological studies is concerned directly with the problem. The only attempt in this direction seems to have been made by Binet and Simon (09) with conclusions very unfavorable to the oral method as of much value in after life. It is interesting to note that they comment upon the difficulty which the oral method encounters because of the lack of intelligence of the deaf, a lack surmised by the authors but not measured. This lack of intelligence has since become obvious in standard intelligence tests.

The Language Ability of the Deaf. — That language ability is no adequate measure of the deaf child is shown by the comparison of deaf and hearing in purely language tests. Pintner and Paterson's (16) comparison by means of the Trabue language scale shows that very few deaf children (only 6.4 per cent) score above fourth grade ability of hearing children. At every age and grade the difference is very great. The same authors (16) have also compared the deaf and hearing on the Woodworth and Wells Directions Tests and conclude that "the average deaf child's ability to comprehend the language involved in these tests is about equal to that of the average hearing child between the ages of six and eight." Again Pintner (18) shows how terribly slow is progress in language ability in the deaf in his attempt to measure gain in language ability over a period of six months, whereas such gain can be measured in hearing children. Reamer (21) shows how the general educational ability of the deaf as tested by standard educational tests lags behind the ability of the hearing. She finds an average retardation of five years in educational ability as compared with hearing children (contrast this with the retardation of two years in mental ability on non-verbal tests). All the studies mentioned in this paragraph agree in finding the adventitiously deaf better in language tests than the congenitally deaf. The adventitiously deaf who lose their hearing after age five or six show decidedly superior language ability. The opportunity for speaking and hearing language if prolonged up to that time seems in general to leave permanent results in later life. The tests do not show any advantage in language ability for the child who possesses hearing for the first four years of life.

Reamer points out that, although manually taught pupils show markedly inferior educational ability in comparison with the orally taught, yet if we take into consideration their intelligence both groups are working equally well. The oral method does not seem to lead to a better comprehension of written English. "Oral and manual pupils of the same mental caliber do equally well on the educational test."

Practical Uses of Tests in Deaf Schools. — Little practical use of tests in deaf schools is reported, although suggestions are made which have to some extent been followed. Classification into homogeneous groups is stressed by Pintner (18), who shows in a particular case how a group of 29 young deaf children tested by means of an individual scale, The Pintner-Paterson Performance Scale, should be grouped into the three beginning classes which were available in the school in question.

The first mental-educational survey of a school was reported by Pintner and Paterson (16), to be followed by the later extensive surveys of 26 deaf schools totalling 2172 children undertaken by Reamer (21). The latter study shows the same great difference in intelligence among schools for the deaf as we have met with in schools for the hearing. The median mental indices of the schools ranged from 37 to 63. The percentage of children rating "very bright" ranges in the schools examined from 5.6 to zero; the percentage of cases rating "dull" from zero to 5.7 per cent. The percentage of cases rating "normal" varies from 71 per cent in the highest school to 22.2 per cent in the lowest. Reamer also makes use of combined mental-educational tests to point out the necessity for more efficient methods of instruction and administration.

Conclusions. — The author has summed up elsewhere (Pintner and Paterson, 18) his opinion based upon his psychological tests of the deaf, and the rest of this chapter is substantially a quotation from this earlier report.

A careful study of the results obtained from our series of experiments reveals at once two outstanding facts: First the startling deficiency of the deaf in their ability to comprehend and handle printed and written language; and, second, the general mental inferiority of the deaf as a group.

At an early stage of our work we discovered that this language deficiency was due almost wholly to the lack of normal social intercourse. With the hearing child incessant social intercourse leads to the development of a speaking vocabulary which serves as a basis for the rapid acquisition of reading ability. Due to the fact that the deaf child is cut off from such language environment he develops a vocabulary very slowly; as a consequence of this he does not have a medium into which he can translate the ideas of the printed page. The difficulties encountered by the deaf in the acquisition of language (regardless of methods of instruction) seem to be well-nigh insurmountable. The fact that language ability is not a reliable index of the native mental capacity of the deaf child makes it necessary to keep the measures of mental ability — that is, our performance tests — separate from measures of language ability. In the case of the deaf child the latter are measures of acquired habits. These acquired habits are greatly affected by the vicissitudes of home and school life, and therefore, do not give us an index as to the child's native intelligence.

In general, the deficiency in language ability and in tests involving the utilization of auditory processes is a characteristic of both the congenitally and adventitiously deaf. Of the latter group, however, those who possessed hearing after the age of four or five are superior, on the average, to the rest of the deaf. This merely shows how necessary is the sense of hearing for the development of language ability.

In considering the mental inferiority of the deaf, the question naturally arises as to the cause of this inferiority in activities that presumably do not involve audition. The results indicate that the adventitious and congenital groups show the same general inferiority in these traits. However, it does not follow that this result is produced by a single cause. It is necessary, therefore, to consider the question for each group separately.

Reliable authorities state that 60 to 70 per cent of deafness occurs after birth. Now, the two chief causes of adventitious deafness are cerebral meningitis and scarlet fever. Since both these diseases are known to affect in many cases the mentality of the normal hearing child, we are tempted to conclude that the mental retardation of many of the adventitious group is caused by the disease which caused the deafness. Instead of deafness being the cause of mental inferiority, we find that the disease which produced the deafness caused at the same time the mental backwardness. We seem, therefore, to have a partial explanation for the inferior mentality of the adventitious group.

In regard to the congenital group, there is no specific disease which can be pointed to as a cause. It is possible that congenital deafness may be due in some cases to pathological prenatal (non-hereditary) causes, which

at the same time affect the capacity for mental development. Two other possible explanations may be offered:

1. That loss of hearing may preclude normal mental growth, even in those traits which presumably do not depend upon hearing for their development.
2. That congenital deafness, on the whole, occurs more frequently in families of inferior mental ability.

The first possibility seems untenable, since there are a number of cases of deaf children showing ability equal to, and in some cases superior to, that of average hearing children. One might reply that these superior congenital deaf children might have shown even better mental ability if they had once possessed hearing. According to this point of view, the average ability of the congenital group would have been higher (even equalling the average ability of hearing children) had they all retained their hearing. In spite of this, however, it does not seem that mere absence of hearing itself is sufficient to explain deficiencies in activities which develop for the most part independently of auditory processes.

Therefore, it is necessary to inquire into the truth of the second possibility. At the outset of such inquiry, we find that there is little or no evidence concerning the family histories of our congenital cases. No investigations have been made which deal with the mentality of these families. Goddard has shown only a small amount of deafness occurring in the inferior families which he investigated. He is unable to draw any conclusions from his data in regard to the point we have raised But he was investigating families in which the principal defect was feeblemindedness. It is obvious that this is not the line of attack that must be made to solve the problem.

We must start with congenitally deaf children and trace back their family histories and measure in some way the mentality of the people comprising the family group. Such an investigation is urgently needed, and until such is made we must wait for a satisfactory explanation of the inferior mental ability of the congenitally deaf.[1]

Although the reason for the mental retardation of the deaf is unknown, the fact that they are, as a group, mentally backward is quite evident. This has been the outstanding result of all the mental tests. The deaf child is, on the average, two or three years retarded in mental development as contrasted with the hearing child. This fact has been brought out both in the individual tests and in the group tests. Tests of space perception, of meaningful perception, of learning, and tests of attention have all shown the same results. These indicate a general inferiority in various mental traits, a general lowering of mental capacity rather than an inferiority in specific traits. Hence this inferiority does not seem to have been caused by the mere fact of deafness. Where mere lack of hearing affects the deaf child's performance (as in visual memory for digits and in tests of language ability), we find the deaf child much more seriously affected and handicapped.

This retardation of two or three years seems to exist all through the school career of the deaf child. It is not an initial retardation which is later on overcome. We find no evidence for a commonly accepted view that a deaf child starts out behind the hearing child and "catches up" later on. We do not believe that the average deaf child ever "catches up" to the average

[1] See the later work of Pintner and Osborn mentioned in Chapter XX of this book.

hearing individual. It must be borne in mind that we are speaking of the average and are well aware of the fact that there are exceptional deaf individuals who are distinctly above the average hearing individual.

This mental retardation applies to the mental ability of the deaf child, as far as we are able to measure it at the present time. It does not apply to the language ability of the deaf child. We feel it imperative to keep language and mental tests entirely separate when dealing with deaf children. The measurement of language ability shows the deaf child to be about four or five years retarded. The enormous handicap under which the deaf child labors in the acquisition of language has been brought out clearly for the first time in such measurements as we have described. For the psychologist, the interest centers largely in the important part that audition is thus shown to play in the language development of the hearing. For the educator of the deaf, it is of interest in pointing out that progress in language must necessarily be slow; that great emphasis must be placed upon it, and that he must realize the limits in this direction and yet not be discouraged. Recognizing these limits, he will not fall into the fallacy of neglecting all else in the attempt to attain an impossible degree of perfection in language, but rather will he be satisfied with little and slow progress, and at the same time utilize all the other time of the deaf child in teaching him those things which will best enable him to take his place as a socially desirable citizen.

The science of education is being based more and more on the theory that it is the function of education to make each individual socially effective. Due to the rise of psychological measures of individual differences,

educators are realizing that special kinds of education must be provided in order that each child may be developed to the limit of his capacity. In view of our results, it would seem that deaf education should more and more emphasize industrial training. Our results indicate that the deaf child, because of his language deficiency is not very well suited for academic instruction. Much of the instruction in geography, formal grammar, physiology, history, Latin and algebra seems to be in large part a useless expenditure of energy. On the other hand, the deaf child is more nearly on a footing with his hearing brother in those motor capacities that are fundamental for industrial success. Hence the deaf child has a greater chance of becoming socially effective if given a real opportunity for thorough and adequate industrial training. The academic instruction should be designed primarily to aid the deaf pupil in mastering the problems in his trade. English instruction should be designed to equip the child so far as possible, for simple social and business intercourse.

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CHAPTER XVI

THE BLIND

The First Intelligence Scale. — The blind, like the deaf, form a very small percentage of the total population, but their handicap is such as to require a very special method of education. The educators of the blind have, therefore, concentrated their attention upon methods of teaching and it is only within recent years that interest has been aroused in the general psychological make-up of the blind individual. One of the earliest workers in this field was himself a blind man, Mr. R. B. Irwin, Supervisor of the Education of the Blind in Cleveland, and his early interest in this work may best be described in his own words, as quoted by Hayes (20): — "In 1914 I went to Vineland with the idea of working with Dr. Goddard on a study of intelligence tests with a view to the revision of some existing scale so that it might be used more appropriately with the blind. It soon appeared that this was not a task that could be completed in one summer or one year. Dr. Goddard assisted me in the collection of all sorts of tests, which I arranged in a tentative order with a view to their being tried out on a large number of blind children. The aim was that they should ultimately be arranged and published in a form that would be useful to any mental examiner. The Binet measuring scale was taken as a basis. Tests which clearly depended upon vision for their proper per-

formance were immediately stricken out. Other tests borrowed from anywhere and everywhere were added to the scale in the year in which they seemed most appropriate. The distribution of these tests was purely a matter of guess-work, and we realized it. After forty or fifty children in the Sunshine Homes were examined it was quite apparent that some of our tests had been placed in the wrong year. I made very little change, however, as I felt that for a long time we must continue to collect data. The test sheets were printed with the view of testing the tests and not the subjects."

Continuing the work started by Irwin, Haines (16) modified and standardized his scale for the blind (see Chapter V). Hayes (20) continued the work with the Irwin-Binet Scale for the blind.

Comparison of Blind and Sighted Pupils. — What little data are available seem to agree in finding the blind as a group inferior to the sighted on comparable intelligence tests. Hayes (20) makes a comparison between 670 blind children, tested by means of the Irwin-Binet tests, and 1000 unselected children as tested by Terman.

	Percentage	
	Blind	*Sighted*
Genius	0.3	0.5
Very Superior	1	2
Superior	5	9
Average	68	76
Dull	12	8
Borderline	7	2
Feebleminded	5	0.3

Pupils above average in intelligence are much less common among the blind than among the sighted. The greatest difference between the two distributions is found in the large percentages of dull, borderline, and feebleminded blind as compared with the sighted. The percentage of feebleminded blind is particularly large.

In the above comparison no differentiation is made between the partially blind and the totally blind. Haines (16) regards this distinction as important and arrives at the conclusion with respect to the totally blind that their intelligence "is not markedly inferior in grade, or different in quality from that of seeing subjects." On the other hand he finds the group of partially blind to be "more heavily laden with distinctly inferior mentalities." He believes "that some subnormality of vision has been made the excuse for constituting the school an asylum for some feebleminded persons who should be in institutions for the feebleminded. After eliminating such persons from the group, the average attainments of the remaining subjects, year by year, came very close to those of seeing subjects." Haines, however, recognizes that the amount of feeblemindedness in the ordinary institution for the blind, where no sharp distinction is made between totally and partially blind individuals, is much greater than the percentage of feeblemindedness in the general population. As in the case of the deaf, some causes of blindness are likewise causes of brain defect and, thus, we find many who are blind and feebleminded because of the same general inadequacy of the central nervous system.

The evidence from group tests points also to the general inferiority of the blind. Hayes (20) reports that the average attainment of 122 blind subjects on the

Pressey group tests is considerably lower than the average for the sighted. In a more extended and detailed study by Hayes (21) in which he used a great many intelligence and educational tests adapted for blind subjects, we note that, wherever adequate comparisons between blind and sighted subjects can be made, the blind are usually inferior at every age. This is true of the Trabue Completion Test, Terman Vocabulary Test, Pressey Practical Information, Opposites, Analogies, Logical Judgment and Moral Judgment. Most of these comparisons are based on over 300 blind subjects in seven schools for the blind.

Practical Use of Tests. — Little has so far been reported as to the practical use of intelligence tests for classification purposes in schools for the blind, although undoubtedly something has been done that has not been published. Holterhoff (21) indicates that attention is being paid to the feebleminded blind and describes the type of education that should be undertaken with blind children whose I. Q.'s are below 70. She suggests that the Revised Braille is better and easier to teach than the American Braille.

Special Mental Functions. — Much has been written upon the special ability of the blind with reference to memory and sensitivity of touch and hearing. The two latter functions do not concern us directly in this book, but it may be mentioned that Seashore and Ling (18) do not find the blind to be more sensitive or keen in sensory discrimination than seeing persons when fundamental capacities are tested, although they are undoubtedly superior in the general use of touch and hearing in practical life. With reference to memory, some have claimed superiority for the blind (Haines, 16) or equal-

ity of the blind and hearing (Bond and Dearborn, 17), but the more extended studies of Hayes (20) with unselected blind children seem to show that in general the blind are only slightly superior in rote memory, but show no superiority in logical memory. Special compensation for their visual defect either in touch, hearing or memory does not seem to exist.

Language and Educational Attainments. — Although in most educational tests the blind are somewhat inferior to the sighted (Hayes, 21), there does not seem to exist the great discrepancy in this respect, as we found to be the case among the deaf. The language ability of the blind is much better than that of the deaf, and being better their whole educational development is easier and more rapid. Nevertheless, the reading of the blind is slow and difficult. Hayes (20) says, "The results as a whole indicate that under present conditions blind pupils attain at the end of their elementary school work a rate of reading only about one-third of that of sighted pupils of the fifth grade, and that they make no appreciable advance during the high school years." In other educational tests the blind are below the hearing. This is partly due to the presence of pupils of low mentality, according to Hayes (20), for he says, "Low mentality, then, affects the course of the curve somewhat, but when the low grade pupils are omitted, the curve is still far below the sighted standards."

Conclusions. — We may summarize this brief chapter by saying that a very good beginning has been made in the intelligence measurement of the blind. Enough research work has been done on the construction of scales, so that useful methods of measurement exist. The results of the tests so far published show the blind

as a group somewhat inferior mentally to the sighted. There is evidently a large percentage of feebleminded-ness among the blind, as we noted in the case of the deaf. Educational achievement among the blind is below the sighted, but probably superior to the deaf. The difficulty of acquiring language is not nearly as great among the blind as among the deaf, because the former learn to speak and talk easily and readily, just as a normal hearing-seeing child. Lastly, there is no evidence that compensation for the handicap of blindness exists in the form of increased sensitivity of touch or hearing, or of better memory ability.

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CHAPTER XVII

THE NEGRO

General Studies. — The universal interest in racial differences has led the psychologist to ask the question as to whether there exist differences in intelligence between different races as measured by our intelligence tests. The most extensive and most satisfactory comparison of any two races by means of intelligence tests has been made with reference to whites and negroes in this country. We shall, therefore, deal with this comparison in this chapter, and reserve for the next chapter the scattered reports of tests of other racial groups.

There is an enormous amount of literature dealing with the negro in America and in many cases the difference between the negro and the white is pointed out. Writers range from a belief in practically no difference in intelligence between the negro and the white to a belief in a very profound difference. Almost always such opinions are based upon mere observation or hearsay knowledge or on studies of social conditions and the like. The work of Odum (10) is a good example of this type of study. He echoes the common opinion that negro children develop up to a certain age and then stop. He says "the brightest students are those from 9 to 13 years of age; the clearest minds seem to be found from 10 to 12 years of age." And again, "After 10 or 12 their development is physical rather than

mental." It is, of course, very difficult to know precisely what is meant by such statements. Obviously a clear understanding of any differences that may exist can only be arrived at by careful and accurate measurements by means of standard tests.

The comparison of the school standing of negroes and whites has been repeatedly made. The study of Mayo (13) is a good sample of this type of comparison. He studied high school students in New York City and found that 29 per cent of the colored reach or surpass the median school mark of the whites. He concluded that the colored are about three quarters as efficient as the white students. Furthermore, they are seven months older than the whites, and progress more slowly through the grades. The colored high school students are in all probability a more highly selected group than the white students. Only the brighter and more ambitious are likely to continue their studies in high school.

Comparison by Means of Intelligence Tests. — The general finding of all investigators seems to be that the negro tests below the white, and this is true at all ages. Binet tests comparing negro and white school children give results like the following:

	Colored		*White*	
Author	*Median I. Q.*	*No. of Cases*	*Median I. Q.*	*No. of Cases*
Schwegler and Winn (20)	89	58	103	58
Pintner and Keller (22)	88	71	95	249
Arlitt (21)	83	71	106	191

It is interesting to note that these three reports agree so closely on the median I. Q. Lacy (18) in a study of 100 repeaters tested by the Binet Tests makes a comparison of the negroes and whites. At each age he finds the intelligence quotient of the whites superior to that of the negroes. He does not give the median I. Q.'s for the two groups, but from his distribution curve we can see that the median I. Q. of the negroes lies between 80 and 90, while that of the whites is probably between 90 and 100. This result for the colored group agrees with those previously quoted.

The early work of Strong (13) using the Goddard Revision of the Binet made a comparison of 125 colored with 225 white children ranging in age from 5 to 15. The results are given in percentage retarded mentally:

	Colored	*White*
More than one year backward	29.4	10.2
Satisfactory	69.8	84.4
More than one year advanced	0.1	5.3

Again the author shows that the colored are more retarded even when compared with the poor whites as represented by the children of mill workers.

Negro college students would seem to test higher than negro elementary school children, just as we would expect, but in comparison with white students, they again fall lower. Derrick (20) gives 103 as the median I. Q. on the Binet for 55 colored students, and 112 as the median for 75 white students. The average chronological age of the white students is five years less than that of the negroes.

Group Tests. — In addition to these studies by means of individual tests, such as the Binet, we have several

in which group intelligence tests were used, and again we note the lower standing of the colored group. Negro children were tested on several different tests by Ferguson (16) and only on one test, the cancellation test, did they exceed the whites. He concludes that the average performance of the colored is only three quarters as efficient as that of the whites. He also believes that there is a decided correlation among the colored between intelligence and the amount of white blood. Pressey and Teter (19) also find the colored below the whites on group intelligence tests. Using their results for over 20 children at each age from 10 to 14 inclusive, which ages they consider give the most reliable data, they find that "only 14 per cent score at or above the median for the white children of the corresponding age. Only 3 per cent of the colored children score above the 75 percentiles of the white distribution. But 54 per cent of the colored children score below the white 25 percentile. To put it another way, the colored children average at about the average for white children two years younger."

Pyle (15) compared colored and white children on thirteen different group tests involving memory, learning ability, association, and so forth. He compares the sexes and different social groups. In general, he finds that "the marks indicating the mental ability of the negro are about two thirds those of the white."

The best comparison by means of group tests of adults and, indeed, the widest and most convincing comparison of negroes and whites in general is to be found in the army data. (Memoirs, National Academy of Sciences, 21.) The mean mental ages and mean scores on the combined scale of intelligence for various samplings are as follows:

	Mean Score	*Mean M. A.*
White Draft	13.5	13.1
Colored Draft	9.9	10.4
White Officers	18.8	17.3

The percentage of the colored reaching or exceeding the mean of the white draft is at most 12 per cent, and probably about 10 per cent. The combined scale is an evaluation of all scales used in the army.

The negro troops, however, score less than the white both on the Alpha and on the Beta Scales. Alpha is a test for literates and Beta for illiterates, so that whether educated or uneducated, the negro is inferior to the white of similar status. The median scores are:

	Alpha	*Beta*
White Draft-native	59	43
White Draft-foreign	47	41
Colored Draft-northern	39	33
Colored Draft-southern	12	20

The percentage of the northern colored reaching or exceeding the median of the native white is on Alpha about 31, on Beta 34; while the percentage of the Southern colored is on Alpha about 6, on Beta 14.

We may also study the difference between the racial groups by comparing the distributions of intelligence ratings, and by doing this we are reminded of the fact that there are negroes who receive the highest intelligence ratings and whites who receive the lowest, although the mode for the negroes is always further towards the lower end. The data below show the superiority of the white draft to the negro draft, the superiority of the white officer to the negro officer, and the superiority of

the northern negro to the southern negro. For the significance of the intelligence ratings, A, B, C, etc., the reader is referred to the appendix of Chapter VI. The figures show the percentages receiving the various intelligence ratings.

Drafted Men	n	D—	D	C—	C	C+	B	A
White	93,973	7.0	17.1	23.8	25.0	15.0	8.0	4.1
Negro	18,891	49.0	29.7	12.9	5.7	2.0	0.6	0.1
Officers								
White	1385	0.1	0.3	0.7	6.2	12.3	31.2	49.2
Negro	95	3.3	10.0	5.3	22.1	21.0	24.2	14.7
Negro (Training)	273	2.2	10.5	20.8	35.6	19.4	8.1	3.4
Section of Country								
Northern Negroes	4705	14.4	31.2	25.8	18.0	7.2	2.7	0.7
Southern Negroes	6848	57.0	29.2	9.6	3.4	0.7	0.2	0.1

From whatever angle, therefore, we look at these results, the marked superiority of the white group is apparent. The education of the negro has been for a long time and still is decidedly poorer than the education of the white, but the difference in intelligence is marked whether we compare the groups on tests for literates or illiterates. The discrepancy is also present when the results of the Binet tests of the two groups are compared. Ferguson (21) discusses the influence of education on the army tests with reference to negroes, and after making what he considers a reasonable allowance for difference in educational opportunity, he sums up by saying " that probably the safest and most reasonable expression of the relative intelligence of whites and

negroes is that approximately 25 per cent of the latter equal or exceed the average of the former." This means, as Ferguson points out, a considerable amount of overlapping between the two groups. We are, however, warranted in saying that a real racial difference exists. The difference between the average white and the average negro in intelligence may not be very great, but it is quite definitely present, and this seems to be the case wherever two comparable groups of the two races have been examined, and even when we make allowance for the differences in educational opportunity.

Differences in Specific Traits. — Many workers, including those we have cited above, have made attempts to find a qualitative difference in intelligence between the two races. With some the motive seems to be to show that the quantitative difference in intelligence between negroes and whites is due to the fact that the intelligence scales used have favored the type of thing which gives a preference to the specific traits in which the white race are superior. In other workers, this motive is not present and they have merely pointed out the traits in which the white and colored are equal, or in which the colored are superior to the white, or they have made a comparison of the colored themselves with regard to different traits. The conclusions to be drawn from the evidence presented are conflicting and difficult to interpret. Let us list some of the suggestions made by different workers:

The negro is better in concrete problems than in abstract. (Derrick, 20.)

The two races are equal in rote memory. (Schwegler and Winn, 20.)

In tests involving common sense adjustment to practical

situations of a familiar type the colored are equal to the white. (Schwegler and Winn, 20.)

In tests of abstract reasoning colored are inferior to white. (Schwegler and Winn, 20.)

The colored children do best in a test of rote memory. (Pressey and Teter, 19.)

The colored do poorest in tests involving a knowledge of abstract terms. (Pressey and Teter, 19.)

Negroes rate lower than whites or Indians on a scale of resistance to fatigue. (Garth, 20.)

Negroes are less accurate. (Baldwin, 13.)

Negro children not superior to white in verbatim reproduction or immediate retention. (Sunne, 17.)

Negroes show a greater facility in control of words, a more fertile imagination as relating to general human activities, and a more original and perhaps more primitive taste in use of colors. (Sunne, 17.)

Lastly in the Memoirs of the Academy of Sciences (21), we have a report based on the Army Tests, as follows: "The report takes the above results to indicate that the negro as compared with the white man of equal intelligence is relatively strong in the use of language, in acquaintance with verbal meanings, and in perception and observation; and that he is relatively weak in judgment, in ability to analyze and define exactly, and in reasoning." Some workers in the army and other investigators find no clearly marked qualitative differences.

A survey of this evidence, in parts conflicting, and as a whole couched in rather vague and general terms, leads one inevitably to the conclusion that we have not yet found with regard to the tests used any clearly marked qualitative differences between the white and the negro. Chance samplings of whites compared with

each other might show the same slight differences which have been recorded as existing between negroes and whites. While we cannot conclude dogmatically that there are no qualitative differences between the two races, we may at least say that any marked qualitative difference in intelligence, as measured by the tests under consideration, does not seem to exist. In saying this we must remember that we are restricting ourselves entirely to the type of intelligence which is largely verbal or abstract; that is the sort of thing which is tested most effectively by the Binet and customary group tests. Mechanical intelligence has been much less effectively measured and social intelligence practically not at all. Furthermore we must remember that we have not raised the question as to emotional and moral differences between the two races. Popular opinion assumes large differences in these traits. There are no scientific measures of these as yet, and speculation about possible differences in this regard does not belong in a book devoted to intelligence testing.

Conclusions. — Our conclusions can be briefly summarized by saying that all results show the negro decidedly inferior to the white on standard intelligence tests. These results are sufficiently numerous and consistent to point to a racial difference in intelligence. The overlapping of the two races is great, and the most liberal estimate seems to be that at most 25 per cent of the colored reach or exceed the median intelligence of the whites. No qualitative difference in intelligence between the two races can explain this marked quantitative difference. Indeed, it is doubtful whether real qualitative differences exist with reference to the traits measured by our intelligence tests.

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CHAPTER XVIII

THE FOREIGN-BORN

Conflicting Opinions. — In none of our topics are the data so unsatisfactory and opinions so conflicting as for this topic of racial differences. Apart from the comparison of the negro and white races in America, which we have discussed in Chapter XVII, we do not have any real comparisons of the intelligence of different racial groups. And we have entitled this chapter "The Foreign-Born," rather than "Racial Differences in Intelligence," to emphasize the fact that the chief data we possess refer to racial groups in this country.

That there are differences in intelligence and in other characteristics between different races, has been assumed by many anthropologists and psychologists writing on this topic. But the opinions as to the amount of such differences vary from practically zero to a fairly large amount. Anthropologists, like Deniker and Tylor (81), assume "lower" and "higher" races, and seem to take for granted differences in intelligence. Deniker assumes a correlation between the brain and intelligence. Tylor says that, "in measuring the minds of the lower races, a good test is how far their children are able to take a civilized education." Boas (11) is a good example of the anthropologist who minimizes the differences between races. The difference in intelligence between civilized and primitive races he believes to be very slight.

Man's " faculties " are in general very much the same. Nevertheless, he concludes that negro intelligence is a little below the white. Le Bon (98) is a good example of the descriptive psychologist who, without any actual measurements, finds appreciable differences between races. In his attempt " to describe the psychological characteristics which constitute the soul of races " he makes a scale of 4 steps: (1) the primitive races, such as the Fuegians, the aboriginal Australians; (2) the inferior, such as the Negro; (3) the average, such as the Chinese, Japs, Mongolian and Semitic races; (4) the superior, such as the Indo-European races. The difference between the groups refers both to character and intelligence. The groups differ, he maintains, in capacity to reason, in power of attention and observation, inability to foresee consequences, and the like.

Let the above serve as samples of psychological and anthropological opinion as to racial differences uninfluenced by the results of actual measurement. Without adequate psychological tests of racial groups, there is bound to be a difference of opinion and further argument seems rather futile.

Sensory Tests. — The first comparative tests of different races were largely tests of sensory qualities. Rivers (04) compared the Todas in India with Englishmen in respect to visual acuity, visual illusions, tactile discrimination, sensitivity to pain, and the like, and found no real differences between the two groups. " Pure sense acuity is much the same in all races." Myers (11) refers to the lack of racial differences found in vision and other sensory qualities by the Cambridge Anthropological Expedition, and jumps rather abruptly to the conclusion that the mind of the average European

peasant is not essentially different from the "primitive" or "backward" races. Some difference in acuity of hearing between more primitive races and whites is found by Bruner (08) in his comparison by means of auditory tests between whites and Ainus, Patagonian Indians, and Pigmies. Woodworth (10) gave many sensory tests to various racial groups represented at the St. Louis Fair in 1904, and concluded that "on the whole the keenness of the senses seems to be about on a par in the various races of mankind." The importance for us of Woodworth's work lies, however, in the fact that he, for the first time, used a test that approximates more to a test of intelligence than any of the sensory and psychomotor tests that had, up to that time, been used. He used the Sequin Form Board and found very little difference between the whites, Indians, Eskimos, Ainus, Filipinos and Singhalese; but he found that the Igorots, Negritos and Congo Pigmies were much poorer on this test as compared with the previously mentioned list of races. We should conclude, therefore, from the above studies that in all probability there are few, if any, marked racial differences in sensory qualities, with the suggestion of possible racial differences in intelligence indicated in the last experiment mentioned.

Intelligence Tests. — When we come to intelligence tests of racial groups, apart from the negro, we find a certain number of data in this country. Whatever conclusions we may arrive at, it is well to emphasize at the beginning that they can refer only to the samplings of the races found in the United States, and that we cannot infer anything at present as to the intelligence caliber of the race or nation to which these individuals belong. Furthermore, it will be apparent as we describe the

results that it is extremely difficult to be sure that the groups tested are even a fair sampling of the racial group as found in the United States. Any particular city or community may for economic reasons attract a certain type of immigrant and the representatives of any particular racial group in that community may not be representative of the race as found in this country. Only by numerous investigations or by a very widespread survey can we be sure of getting a fair sampling of any racial group.

Another difficulty in making comparisons of racial groups and one that has retarded the work a great deal, is the language factor. Until recently there were no adequate non-language tests available. If language tests are used the foreign-language-speaking group may be severely handicapped, even although the children are born in this country and speak English. Some workers, notably Young (22), believe that with English-speaking children of foreign parentage this handicap is negligible and that they can be legitimately tested on such tests as the Binet. Pintner and Keller (22) have shown that this is a questionable assumption. In going over the data pertinent to our topic, let us, therefore, always keep in mind these two difficulties, namely, the difficulty of getting a fair sampling of any racial group in this country, and the inadequacy of language tests for foreign-language-speaking groups.

Italians in America. — We possess more data on Italian children than on any other foreign group. The results of Binet tests comparing Italian and native Americans are as follows:

	Median I. Q.		
Author	*American*	*Italian*	*No. of Italian Cases*
Arlitt (21)	106	85	87
Pintner and Keller (22)	95	84	313
Brown (22)		77.5	51
Young (21)		84	25
Dickson (see Young 22)	105	84	?
Bere [1]		83	100

There is a remarkable agreement in the median I. Q. for the Italian children in the six studies. The geographical distribution of the cases is wide, namely, Ohio, Michigan, California, New York and presumably Pennsylvania. Arlitt stresses the difference in social status between the Americans and the Italians as one reason for the wide difference. When she compares Americans and Italians of inferior social status the difference between the I. Q.'s is less, namely, 92 and 85 respectively. Pintner and Keller believe the I. Q. of the Italian group to be somewhat lowered because of the language handicap. Brown also recognized the language difficulty and tried to avoid it by having foreign children tested in their native language in doubtful cases. What is a doubtful case would be difficult to determine, because he himself says, "not infrequently we found children who, although they spoke the English language fairly well, tested from six to eighteen months higher when their native language was employed." The median I. Q. of the Italians in the United States may not, therefore, be as low as is indicated by the results, but even

[1] From the unpublished manuscript of Miss Bere, to whom the author is indebted for permission to use her results.

making allowances for the factors mentioned, it is probable that it is below 100.

Young (22) made use of group tests in his comparison of American and Italian twelve-year-old children. Calculating an approximate I. Q. from his results with the Army Alpha, we get:

	I. Q.	*No. of Cases*
Americans	107	402
Italians	88	248

If, however, we make the comparison on the basis of the Beta findings and calculate the approximate I. Q.'s, we get:

	I. Q.	*No. of Cases*
Americans	109	393
Italians	96	246

This I. Q. of about 96 for the Italian group is higher than that obtained in any other study. As compared with the results on the Alpha or verbal test, it shows the handicap of language in trying to cope with a verbal test, although Young himself is not willing to accept this conclusion.

Other Racial Groups in America. — For no other racial groups have we such adequate data as for the Italians. Other median I. Q.'s on the Binet for various groups reported by three of the authors quoted above are as follows (the figure in parenthesis after the median I. Q. gives the number of cases):

Racial Group	*Pintner and Keller*		*Brown*		*Young*	
English	97	(24)	102	(90)		
Canadian	89	(3)				
Scotch	88	(8)				
Irish	92	(5)				
Welsh	93	(7)				
German	91	(37)	102	(67)		
Swedish	104	(3)	102	(187)		
Norwegian			104	(34)		
Spanish	93	(2)			78	(37)
Portuguese					84	(23)
French	125	(1)	95	(199)		
Austrian	94	(3)	100	(28)		
Slavish	85	(130)	86	(31)		
Polish	85	(11)				
Russian	89	(10)				
Croatian	86	(5)				
Hungarian	89	(99)				
Roumanian	97	(18)				
Greek	83	(12)				
Finnish	94	(4)	90	(226)		
Chinese					97	(109)

Young's (22) results for Portuguese and Spanish-Mexican children may be summarized as follows:

	I. Q. Alpha	*No. of Cases*	*I. Q. Beta*	*No. of Cases*
Portuguese	87	77	96	75
Spanish-Mexican	87	51	96	53

From such results as these it would be dangerous to draw any very definite conclusions. Our data are much less extensive and more ambiguous than for the Italian group. We need many more investigations of racial

groups. At present it might look as if the groups coming from southern Europe are inferior in intelligence to those from northern Europe. The language handicap of the former group is likely, however, to be greater because they represent the more recent immigration. More extensive comparisons, preferably by means of non-verbal tests are clearly indicated.

Army Results. — Some confirmation of the results above is given by the army comparison of racial groups. Here we are dealing with adults tested by means of group tests. In this case, the men are all foreign-born, whereas with the children most of the cases are American-born children of foreign parentage. The army results are expressed in terms of the combined scale, which is a composite of the Alpha and Beta tests. Men who could not read and write English were given the Beta, a non-verbal test. The results given below show the average score, the equivalent mental age and the number of cases.

	Canada	British Isles	Denmark Norway Sweden	Germany Austria	Greece	Russia	Italy
Mean Score	13.7	13.4	13.3	13.2	11.9	11.2	11.0
Mental Age	13.3	13.0	12.9	12.9	11.9	11.3	11.2
No. of Cases	948	1214	1610	597	573	2701	4002

The difference between the northern European and the southern and eastern European group is marked. With reference to the Italian group it is interesting to note that if we assume age 14 as the average mental age of adults and divide the Italian mental age of 11.2 by this, we arrive at an I. Q. of 80, which agrees well with the I. Q. of Italian children found by means of the Binet.

The army data allow us to make a comparison of for-

eign groups with reference to the percentage of superior and inferior men. Below are given the countries ranked in order according to the percentage of men receiving intelligence ratings of A or B, in the second column the per cent of A or B men is given, and in the third column the per cent of inferior men, i.e., men receiving intelligence ratings of D, D— or E:

Country	*Per Cent* A. B.	*Per Cent* D, D—, E
England	19.7	8.7
Scotland	13.0	13.6
White draft	12.1	24.1
Holland	10.7	9.2
Canada	10.5	19.5
Germany	8.3	15.0
Denmark	5.4	13.4
Sweden	4.3	19.4
Norway	4.1	25.6
Ireland	4.1	39.4
All foreign countries	4.0	45.6
Turkey	3.4	42.0
Austria	3.4	37.5
Russia	2.7	60.4
Greece	2.1	43.6
Italy	0.8	63.4
Belgium	0.8	24.0
Poland	0.5	69.9

Here again the tendency for the men from northern Europe to be superior is apparent. Belgium is a notable exception. England and Scotland contribute a larger percentage of superior men than is found in the white draft in general. These two countries also contribute fewer inferior men than are found in the white draft.

If the countries were ranked according to the percentage of inferior men, the rank order would be somewhat changed, but not materially. Belgium would rise considerably in the scale. The southern and eastern European countries contribute by far the largest percentages of inferior men. These percentages are very great for Russia, Italy and Poland. In spite of all the qualifications mentioned above in reference to the tests of children, the general agreement of the results in the army with the Binet tests of foreign children lead to the conclusion that there are probably real differences in the intelligence of the racial groups that are attracted to this country.

American Indians. — What results we have here seem to show the Indians inferior in intelligence to the whites, although the evidence is very scanty. Rowe's (14) early work contrasting Indian and white children on the Binet tests shows 94 per cent of the Indians testing below age as compared with only 21 per cent of the whites. Hunter's (21) comparison by means of the Otis group test shows a median score for the Indians of 83, as compared with a median score of 123 for the whites. Both Hunter (21) and Garth (21, 22) have made comparisons of full and mixed blood Indians in which all comparisons point to the superiority of the mixed bloods. These results will be discussed more fully in the chapter on Heredity, Chapter XX.

Racial Comparisons Abroad. — The difficulty of comparing different racial groups is largely one of getting adequate tests which are equally fair to the groups to be compared. Tests involving language, when translated into various languages, can never form an adequate comparison. Non-verbal tests seem to the writer to offer

the only possibility. So far, very little work along this line has been done. We may quote as a sample of this type of work the comparison of two Indian groups by Herrick (21) in India. He compared the performance of Panchama and Brahman children by means of the Goddard Form Board. The Panchamas belong to the lowest castes, the Brahman to the highest. The results show the Panchamas somewhat below the Brahmans at most ages, but the difference between the two groups is not large. Both groups seem inferior to the norms for American children.

A comparison of Chinese college students in China with American college students in this country has been made by Walcott (20). The Chinese were tested by means of English language tests as they were all thoroughly familiar with that language. On the Terman Revision 44 out of 63 have I. Q.'s above 100. On a group test the median score for the Chinese is below that for the American students. It is obvious, however, that we cannot get any indication of racial differences in intelligence from such studies.

Pyle (18) reports the results of several mental tests given to 500 Chinese children ranging in age from 10 to 18 years. These tests are rote memory, logical memory, substitution, analogies and spot pattern. Comparing the results with his norms for American children, he finds the efficiency of the Chinese boys to be about 84 per cent of the efficiency of American boys, and Chinese girls about 77 per cent of American girls. Most of this difference he believes to be due to environmental differences between the two races.

The Immigrant. — Very little actual testing of the immigrant at the time of his arrival in this country has

been done. Feeblemindedness is one reason for refusing admittance and a certain number are deported for this reason every year. No general intelligence test is given to all immigrants, and under existing conditions is very likely not practicable. The cases of feeblemindedness detected by the medical officers are in all probability of low grade. Detection is more likely to occur where mental inferiority exists along with some physical defect.

The reports of Goddard (13; 17) are among the very few which we possess dealing with actual testing at an immigrant receiving station. Goddard believes that trained workers with the feebleminded could pick out by inspection as the immigrants walk past about 90 per cent of the feebleminded cases in contrast to only 10 per cent selected by the physicians. There is no evidence, however, for this belief.

Tests were made under Goddard's direction at the immigrant receiving station at Ellis Island, New York, in 1913. The tests used were the Binet Scale, as well as three or four performance tests. The testing was carried on by means of interpreters. The groups chosen for testing were selected in the sense that they were taken after the physicians had culled out all the obviously feebleminded. To offset this Goddard's workers passed over the "obviously normal." This left what Goddard calls the "great mass of average immigrants." This method of selecting cases makes it difficult to tell exactly what sort of groups were tested, and it makes it still more difficult to interpret the findings.

The following results are given in per cents:

	Normal	*Borderline*	*F. M.*	*No. of Cases*
Jews	10	7	83	30
Hungarians	0	20	80	20
Italians	7	15	79	48
Russians	0	9	87	43

All of the groups show an abnormally high percentage of feeblemindedness, and this is due in all probability to the method of selection and the standards used for interpreting the results of the tests. No one is willing to believe without much more adequate evidence that the percentages given above are representative of the intelligence caliber of the various immigrant groups.

However inconclusive these data are, they, nevertheless, raise the very practical question of the value of intelligence tests in the selection of the immigrant. We may say that the problem is now entirely one of administration or procedure, because there are now a sufficient number of individual performance tests and group nonverbal tests to enable examiners to give an adequate intelligence examination. The question as to what level of intelligence should bar the immigrant is one that could readily be established after some experimentation. Indeed, the level might fluctuate somewhat according to the number of immigrants that the country might decide to admit each year, but a certain level might well be established below which none would be admitted because of their low mental capacity. Whether such tests should be given in the country of origin or at this side of the ocean are questions of administration involving many difficulties. It is well, however, to remember that we already have established the practice of refusing admis-

sion to immigrants because of mental defect. It remains, therefore, merely to conduct the selection by well established psychological methods of intelligence measurement.

We need here only indicate the social significance of this problem. Mental ability is inherited. The population of the United States is largely recruited by immigration. The country cannot afford to admit year after year large numbers of mentally inferior people, who will continue to multiply and lower the level of intelligence of the whole nation. Our tests, although inconclusive, would seem to indicate that the level of certain racial groups coming to this country is below that of the nation at large. Increased vigilance is, therefore, required. Literacy tests and restriction of groups based on quotas apportioned to the racial groups already here are all helpful and tend perhaps in the long run to raise the average intelligence level of the immigrant as compared with unrestricted immigration. But these checks are by no means sufficient. Indeed the last measure may at times be harmful, if it checks immigrants of high mental caliber coming for some reason or another from a country whose quota happens to be small, because for historic reasons that country does not happen to be well represented at present in the United States. It would be well, therefore, to emphasize the intelligence factor in the selection of our immigrants to a much greater extent than we do at present, lest the whole nation be diluted with stocks of inferior mentality. Intelligence is to be sure not the only factor to be considered in the selection of the immigrant. There are questions of health, physical well-being, moral qualities, questions of race, and the like. But intelligence is an important

factor and one that has been neglected up to the present.

Conclusions. — Racial groups, other than the negro group, have up to the present time not been satisfactorily measured for intelligence. We can only say in the most general terms that we believe there are racial differences in intelligence. We cannot with any degree of certainty designate which races are superior and which inferior in intelligence. At most, we can point to some very primitive races and say that a few inadequate tests seem to confirm our belief in their lower intelligence.

With a slightly greater degree of certainty we can say that tests of certain racial groups as represented in this country seem to indicate intelligence differences. The races from the south and east of Europe seem inferior in intelligence to those from the north and west. Apart from these general indications we know nothing of the intelligence levels of the immigrants who are coming here. A fertile field for research would lie in this direction and the practical results coming from such research might well prove to be of untold value for the future of these United States.

We need also more comparisons between races in their home countries. Non-verbal and performance tests might well be constructed so as to be equally valid for several or all races. Some work on such tests is now being carried on by several workers and the future will probably see attempts to compare the intelligence of samplings of different races in different countries. Here again there is much opportunity for research. Such work will help inhibit the assumption of racial differences now so often made on merely subjective evidence. Differences certainly exist. Measurement alone can tell us where and to what extent.

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CHAPTER XIX

THE EMPLOYEE

The Value of Intelligence Tests. — The applications of psychology to industry and to the problems of vocational advice and guidance are far-reaching and complicated. The use of intelligence tests in this connection is merely one item in the problem. It is not the purpose of this chapter to attempt a résumé of the whole field. We shall be concerned only with the use of intelligence tests with the employee or prospective employee.

In the field of business and industry the psychologist has contributed most in the direction of the selection of individuals for positions. Relatively little has been accomplished in the more difficult task of the selection of positions for individuals. (Ayres, 13.) If we consider merely the various kinds of tests constructed by the psychologist, disregarding rating scales, job analysis, personnel specifications and other useful dévices and methods, we may roughly divide them into (1) trade tests; (2) specific ability tests; (3) general ability tests.

Trade tests determine the amount of knowledge of or skill in any particular job. They are essentially achievement tests, analogous to educational tests in the school. They are not prognostic. They measure the amount of accomplishment which the individual now possesses. These tests were developed in the army (Personnel System of the U. S. Army, 19) and they have

been described at length by Chapman (21), and by Toops (21). Specific ability tests are such as attempt to measure those special abilities which are supposed to enter into any particular job. Sometimes these tests resemble very closely the actual operation, physical or mental, which the worker goes through in the performance of the job. At other times the test is very different from the job, but the performance of both is supposed to involve the same kind of ability. The third type of test is the intelligence test proper, which is not a test of trade ability and makes no presuppositions as to resemblance with specific abilities required for specific jobs. It is with this last type of test that we shall deal more particularly in this chapter. Obviously there can be no sharp line drawn between the three types of tests and certainly not between the second and third. As we shall see, tests for the selection of various sorts of workers are very often a combination of the second and third types.

The value of a general intelligence test in the selection of workers will depend largely upon the aim or purpose of the testing. If the only purpose of the psychological test is to fill a particular job more or less satisfactorily, then we may agree in general with Viteles (21) when he says, "Such tests have a very limited place in industry. They are used in the first place, to shut out from employment the feebleminded, those who are altogether unfit for any job in the plant by reason of deficiency in mentality. They are also used to select workers for jobs in which success depends, to a very great extent, upon a high level of general intelligence, namely, the executive positions. For selection for the great mass of skilled and semi-skilled jobs, for office

jobs and simple clerical jobs, the general intelligence test cannot be used. The carpenter and the toolmaker, for example, must stand on approximately the same level with reference to general intelligence, but very different specific abilities are required for these trades." If, however, the employment manager conceives his function to be broader and more comprehensive than merely filling satisfactorily a specific job, we will agree heartily with Carney (19) when he says, "The modern employment manager is not satisfied when he has merely introduced the applicant to his first job in the organization. He feels that he must follow up this first placement by such transfers and promotions as are necessary to bring out all the best that the man is capable of attaining. To do less than this is not only unfair to the individual, it is also poor business. For nothing makes for a loyal force of enthusiastic workers so much as a vigorous educational and promotional program. The fact that those in high places have risen from the ranks is the strongest argument that there is a future for men of ability in the organization, and men of ability cannot be held long at any wage where they feel they are working in a blind alley. Therefore, in a set of tests for shop clerks it is essential to introduce measures of general intelligence which will pick out the men in whom it is worth while to invest broad training with the hope that they can ultimately become understudies for executive positions. For while no correlation was discovered between general intelligence and success as routine time-clerks, considerable correlation appeared between general intelligence and success in positions of greater responsibility. Probably even a moron, if he possessed peculiar talent for that special work, might write time-

tickets successfully. But the ability to organize work and to train subordinates requires intelligence which is readily recognizable through tests."

The value of intelligence tests will, therefore, vary according to what we are trying to achieve, whether it be the selection of workers for specific jobs, or the selection of high grade individuals to be trained for important positions, or, again, the elimination of low-grade material. The importance of this last point is stressed by Rossy (17), and he calls attention to the fact that low grade individuals will probably increase the number of industrial accidents, help to lower the output, perhaps produce an inferior product and certainly increase the percentage of labor turnover. The feebleminded and the psychopathic he regards as particularly dangerous. Mental examinations can eliminate these.

The Intelligence Level of Various Occupations. — The most comprehensive comparison of the intelligence level of men employed in various occupations is afforded by the results of the army intelligence tests (Memoirs, 21). The distribution of intelligence ratings and the median scores for a great many different occupations have been computed. The following list shows occupations well represented in the army ranked according to the median scores. The intelligence rating of the median for each group is given. For the significance of these letter ratings the reader is referred to pages 228–229. These data are based upon results for over eighteen thousand men.

Occupation	*Median Intelligence Rating*
Laborer	C —
Miner	C —
Teamster	C —
Barber	C —
Horseshoer	C
Bricklayer	C
Cook	C
Baker	C
Painter	C
Blacksmith	C
Carpenter	C
Butcher	C
Machinist	C
Hand Riveter	C
Telegraph Lineman	C
Pipefitter	C
Plumber	C
Toolmaker	C
Gunsmith	C
Mechanic	C
Auto-repairman	C
Auto-engine mechanic	C
Auto assembler	C
Ship carpenter	C
Telephone operator	C
Concrete Construction Foreman	C +
Stock-keeper	C +
Photographer	C +
Telegrapher	C +
R. R. Clerk	C +
Filing Clerk	C +
General Clerk	C +
Army Nurse	C +
Bookkeeper	C +
Dental Officer	B

Mechanical Draughtsman	B
Accountant	B
Civil Engineer	B
Medical Officer	B
Engineer Officer	A

These results do not mean that all the men in any one group achieve the intelligence rating assigned to that group. In most occupations men of all grades of intelligence are to be found. Inspection of the detailed results of the army data reveals at once a great overlapping between groups. The spread of the middle fifty per cent of each group is considerable. Nevertheless, it is obvious that a selective process is at work, which tends to prevent men of low intelligence from filling certain positions, and which favors the men of high intelligence for certain positions. As Thorndike (19) puts it: "No less significant is the variability within each occupational group. Taking the measurements as they stand, the 75 percentile unskilled laborer is up to the level of the median general mechanic, tool room expert, or automobile mechanic and up to the level of the 25 percentile mechanical engineer. The 75 percentile railroad clerk is at the level of the average accountant or civil engineer. The 75 percentile receiving or shipping clerk is at the level of the 25 percentile physician. This variability would be reduced by longer and repeated tests, but, unless the test as given has a very large probable error, it would still be enormous. It would still imply that there were in the occupations supposed to give little opportunity for the use of intellect, a very large number of gifted men and consequently a large unused surplus of intellect."

Again with reference to the army data, we must remember that they give us a picture of the situation as found in the army and this picture is not necessarily the same as exists in civil life. The discussion in Chapter 15 of the Memoirs (21) refers to the fact that the distribution of occupations in the army was influenced by the selective service act. "More than seven-tenths of those registering were placed in the deferred classes." It is obvious, therefore, that many occupations will not be adequately represented in the army occupational list. In some occupations the selective service act would tend to keep out of the army many of the most intelligent men. The farmers in the army were probably largely represented by farm laborers, because of the selective influence of the draft. Nevertheless, these army results are the best that we have at the present time and unquestionably indicate the importance of the factor of intelligence in various occupations. Further work of this sort may lead to the estimation of lower limits of intelligence for various occupations, in the sense that a certain minimum of intelligence is required for success in each occupation. An individual who does not possess the minimum required for a specific occupation should be advised not to plan to enter the occupation in question. Such limits of intelligence would be invaluable for the vocational counselor.

The Unemployed. — No results comparable to the army results can be given for the unemployed. In the investigations to be mentioned the tests employed are so different as to afford no basis for comparison. Only in a general way can we say that the unemployed as a group give the impression of being very low in intelligence. Pintner and Toops (17) tested 94 cases in

one city and 40 in another, and give the following percentage distribution:

	City A	*City B*
Feebleminded	28.7	7.5
Borderline	29.8	25.0
Backward	28.7	32.5
Normal	8.5	20.0
Bright	4.3	15.0

Johnson (17) tested 107 unemployed and estimates 21 per cent of them as feebleminded. No importance should be attached to the actual percentage of feebleminded-ness obtained by these workers. Such results should be taken merely as an indication that low intelligence is likely to be very common among the unemployed. The lower the intelligence of the individual, the harder will it be for him to obtain a job and the harder to retain a job, because he will in general be the one to be dismissed when times are hard and jobs are few.

Intelligence Tests as Aids in Selection. — By far the most common use and, perhaps, the most important use of intelligence tests in industry and business has been as an aid in the selection of individuals for various kinds of work. As a rule the intelligence test is only a part of the means employed for selection. It is very obvious that it must always remain a part. The judging and classification of men is a difficult and complex task, as Thorndike (18) and Kelly (19) have shown.

The general value of intelligence tests in industry has been pointed out by many writers (e.g., Scott, 16; Whipple, 16) and Lamb (19) has given an account of the use of such tests in a large manufacturing plant, particularly as an aid to the employment manager.

A common method of selecting and evaluating tests is described by Hollingworth (16) as follows: "In a recent investigation an attempt was made to discover a set of mental tests which would aid in the selection of efficient workers in a specific field. Thirty workers who were already employed under fairly comparable conditions of work were taken as subjects in a preliminary search for tests of value. These thirty people were each put through a series of association tests, of the familiar laboratory form, naming opposites, naming colors and forms, completing mutilated passages, following hard directions, giving responses bearing specified relations to stimulus words, cancellation, number checking, etc. While these tests were in progress, during a period of several days, the thirty workers were rated by three supervisors who were familiar with their work at the actual task, and who had for some time been observing their performance with a view to making subsequent judgments. Each superior arranged the thirty workers in an order of merit, according to his or her impression of their relative efficiency. The judgments of the three supervisors were then averaged and each worker assigned a final position on the basis of these averages. This was believed to be as accurate a measure of actual ability as could be secured under the complex conditions of work. The results of these ratings were then compared with the results of the mental tests. Some of the tests were found not to correlate with the ratings for actual working efficiency. Three tests showed definite and positive correlations. When results from these three tests were combined, the records correlated with the ratings by a coefficient of fifty-five per cent. These three tests were then accepted as

having value in the selection of good operators, and search was continued for further tests which might also yield positive correlations."

Poull (22) shows that different types of intelligence tests may have value as indicators of different sorts of interest among children. She found that children who expressed interest in mechanical occupations obtained higher scores on the Pintner Non-language Test than on the National Verbal Intelligence Test. In this way different kinds of intelligence tests may be of significance in vocational guidance.

We may now briefly survey the different occupations in which intelligence tests have been used or in which tests have been employed to help in the selection of applicants for such occupations.

Clerical Workers and Executives. — By far the largest use of intelligence tests has been made in connection with such positions. Thorndike and Scott have for a long time made use of intelligence tests in the examination of applicants for clerical and executive positions. Notable in this connection are Thorndike's tests for the Metropolitan Life Insurance Company. Ordinarily in the construction of tests for selection purposes, the intelligence test is only one part of the total examination. Thus Thurstone (19) and Carney (19) use intelligence tests as part of their general clerical examination, while Bregman (21) uses the conventional intelligence tests almost entirely. Flanders (18) makes use of the Stanford-Binet Scale. Gardener (17), giving a report of the practical situation in the employment manager's office, includes intelligence tests as one of five valuable sources of data about the applicant, the other four being personal interview, physical examination, interview with

foreman and references from other employers. Most of these reports stress the importance and value of intelligence tests as a part of the total sizing-up of the individual. Intelligence alone, however, is not enough and cannot be the sole criterion. Flanders found no positive relation between degree of intelligence and the rating of the men as to all-round efficiency, dependability, loyalty and coöperativeness. At any particular job we may find men possessing a much greater amount of intelligence than the job in question demands. They may be too intelligent for the job. Unless they are well endowed with other useful moral and social qualities, their attitude towards their work may be less desirable, and hence their total value to the firm of less account than that of other less intelligent individuals.

Salesmen. — The use of tests for the selection of salesmen has been stimulated most of all by the work of Scott. His tests and modifications of his tests have been used by many stores and industrial concerns. Hollingworth and Poffenberger (17) show how intelligence tests correlate with the average salary per year of experience of a number of salesmen engaged in selling all manner of commodities. Oschrin (18), and later Oschrin Bregman (21), reports the use of tests for the selection of saleswomen in a New York department store. Various tests and combinations of tests were used and they seemed to discriminate between good and poor salesclerks. The tests were then used for the selection of new employees. The most satisfactory tests proved to be Directions, Judgment and Comparison — all essentially intelligence tests.

Stenographers. — Tests for the selection of stenographers, typists and comptometer operators have

been reported by Rogers (17) and Bills (21). Both authors feel that intelligence tests are valuable aids in such selection. Bills also introduces the Downey Will-Temperament Tests. He finds that the general intelligence test is the most efficient for eliminating failures. "Failures can be predicted by the tests with over 85 per cent accuracy." The mean score on the intelligence test for various groups of stenographers is "for secretaries, 144; for stenographers rated 'good,' 110; for stenographers rated as 'getting by,' 65; and for those failing, 63." A certain amount of general intelligence is necessary for success in these occupations and persons not coming up to a certain standard should be advised against training for the work.

Telegraphers. — Jones (17) and Thurstone (19) report investigations with mental tests for selecting telegraphers. Jones finds a high correlation between ability to succeed in a school for telegraphers and six tests, whereas Thurstone does not find such a high correlation. Just how large a part general intelligence plays in success in telegraphy is, therefore, doubtful. Thurstone feels that "general intelligence tests are not as valuable for diagnosing ability to learn telegraphy as for measuring general intelligence. Ability in telegraphy is probably a special ability."

Policemen and Firemen. — As part of a civil service examination for the selection of policemen and firemen Terman (17) reports the use of the short form of the Stanford-Binet along with some educational tests. The range in mental ages was from 10 to 18, with a median mental age of 13.5 or an I. Q. of 84. It was recommended that all men with I. Q.'s below 80 be rejected, and this recommendation was accepted. There is no record of the

future success of the men who were selected, nor can we know whether those rejected might not have developed into good policemen or firemen.

Semi-skilled and Unskilled Workers. — The lower down the scale of industry we go, the less valuable do our present intelligence tests appear to be for the selection of workers. Otis (20) finds no relation between a performance intelligence examination and the productive ability of 400 workers in a large silk manufacturing concern. A large percentage of these mill workers were foreign or illiterate and so the performance type of examination was used. Otis comes to the conclusion that "intelligence is not only not required in a modern silk mill for most operations, but may even be a detriment for steady efficient routine work. What qualities are required remain to be sought. Whether they are measurable is doubtful. They may be stolidity, patience, inertia of attention, regularity of habit, etc."

With a group of eight tests, mostly of the sensory-motor type, Link (18) finds in general positive correlations with efficiency in shell inspecting and shell gauging in an ammunition factory. He concludes that three of these tests will prove useful in the selection of applicants for these jobs. His work bears out the conclusions of Otis in the sense that the only test of the eight used by Link that might be called a general intelligence test correlates very slightly with the abilities in question and is not retained by him for future use for selection purposes.

Aviation. — Although the aviator can hardly be called an employee in the sense of that term as used in this chapter, mention must be made of the use of tests for the selection of aviators. We have already quite an

extensive literature on the subject and Dockeray and Isaacs (21) have given us an excellent summary of psychological research work carried on in Italy, France, England and the American Expeditionary Forces. Reaction time tests, tests for emotional stability, for equilibrium, steadiness and the like are common. Very extensive were the investigations upon the effect of altitude on various types of response. Stratton and others (20) report tests of judgment of curves, of relative speeds, reaction times, muscular exertion and fatigue. And Henmon (19) gives correlations of flying ability with mental alertness, emotional stability, swaying, visual reaction and several other tests. It is interesting to note that mental alertness and emotional stability show the highest correlations with flying ability of the ten tests reported.

Thorndike's Mental Alertness Test was given to several hundred cadets at the aviation ground schools and showed a correlation of 50 with their average grade in school work. Thorndike recommends the use of this intelligence test as one test among nine for the selection of prospective aviators. Other factors of importance are athletic achievement, athletic mechanical ability, emotional stability and a delicate sense of balance. Achievement as an aviator, Thorndike (19–20) shows correlates as follows:

With education	about zero
" athletic ability	" .15
" athletic-mechanical ability	" .2 to .3
" wage in civil life	" .1
" social achievement	" .04

Dockery and Isaacs (21) stress the factor of intelligence when they say, "What seems most needed by the aviator is intelligence, that is, the power of quick adjustment to a new situation and good judgment. He need not be so quick in motor adjustments, provided he thinks clearly or makes quick mental adjustments."

Summary. — In this chapter we have attempted to describe the work done in intelligence testing in so far as it refers to the man engaged in some occupation or trade, and we can divide this work into two parts. In the first place we have the measurement of the intelligence of men in different occupations, and in the second place, the search for tests which will predict success in some occupation.

The facts as to the intelligence of employees give us a hierarchy of occupations arranged according to intelligence. These facts show how intelligence is distributed at the present time in various lines of work. A natural, but probably very rough, selective process is going on all the time, whereby the less intelligent are relegated to simpler occupations and only the more intelligent survive in more complex occupations. The rough facts as we know them today may serve, therefore, as a tentative guide for vocational advice.

The more immediately practical work is the use of tests for selection. Here we find that intelligence tests are useful, but that they alone will not suffice for accurate prediction. To fill successfully a position and to hold it requires other attributes besides general intelligence, although a certain minimum of intelligence will be necessary for each particular job. Hence the use of intelligence tests for selection purposes will vary greatly according to the job to be filled. Their use,

furthermore, will depend upon the immediate aim of the selection, whether it be to fill just one particular job or to select a candidate who can fill the job in question, but in addition grow and develop into more important positions in the firm.

Obviously there is a close relationship between the first type of work, the determination of the intelligence level of various occupations, and the second type of work, the selection of candidates for jobs. Unquestionably the distribution of intelligence among different occupations today is not the most economical nor the most effective. There must be thousands of workers who are forced to toil at tasks far below their intelligence level, and on the other hand hundreds who are struggling to fill positions which are beyond their intellectual reach. Both are maladjusted, and maladjustment means unhappiness and inefficiency. We may hope, therefore, that in the future intelligence tests and psychological tests of all sorts will prove a means whereby a scientific adjustment of the worker to his work may be attained, resulting in increased satisfaction to the worker and increased efficiency in the work.

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CHAPTER XX

THE INHERITANCE OF INTELLIGENCE

The Pioneer Work of Galton. — That all sorts of traits, physical as well as mental, are inherited is a truism at the present time. The work of the biologist has now gone far beyond establishing the fact of inheritance. He is investigating and throwing light upon the mechanism of inheritance. The biologist has for the most part been concerned with physical characteristics. The laws governing the transmission of such traits are equally true for mental traits.

The pioneer work in the study of the inheritance of mental characteristics was done by Galton (69, 74, 83), the founder of the eugenics movement. He begins his book, *Hereditary Genius,* with this significant sentence, "I propose to show in this book that a man's natural abilities are derived by inheritance, under exactly the same limitations as are the form and physical features of the whole organic world." His work is a study of the family history of 977 eminent men. He finds that these men had 332 eminent fathers, brothers or sons and 203 eminent grandfathers, grandsons, uncles or nephews, that is a total of 535 eminent relatives. The probable number of eminent relatives for 977 average men is estimated at 4. Other studies by Galton deal with the inheritance of scientific aptitude, artistic ability, as well as with such physical traits as stature, eye

color and certain diseases. Further studies of eminent men were later made by Cattell (03) and Ellis (04).

We may say that Galton's work contained the elements of two methods for the study of inheritance, namely, the family history method, and the mathematical method. The family history method is a detailed study of all the members of a particular family group, in order to show the repeated occurrence of a given trait in the family group. If the trait is present in several generations, the chances are that it is inherited. The mathematical method, on the other hand, concerns itself with showing that related individuals are more alike with reference to certain traits than are unrelated individuals. This resemblance is generally expressed by a coefficient of correlation. We shall survey the evidence for the inheritance of intelligence as offered by these two methods.

The Family History Method. — Apart from Galton's work dealing with the family histories of eminent British men, the first extensive study by the family history method was made by Dugdale (77) in America. It is doubtful whether this work was due to the influence of Galton. The work, however, is important, because it later stimulated many other studies in this country. Dugdale shows how the Jukes family, descended from Max Jukes in the eighteenth century, increased and multiplied, always exhibiting the three traits of prostitution, crime and pauperism. Dugdale tends to speak of these three factors as if they were directly inherited. We would be inclined now to say that the descendants of Max Jukes inherited certain mental, moral and physical traits which would lead to crime, prostitution and pauperism in the ordinary environment of civilized life.

It is of interest to note here the continuance of the Jukes family in the twentieth century. Estabrook (16) went over Dugdale's work and brought the family history down to 1915. While Dugdale's genealogy includes 709 persons, Estabrook's contains 2820. Of this number Estabrook estimates that 131 or $4\frac{1}{2}$ per cent were so feebleminded as to need custodial care. Of the 1258 descendants living in 1915 he estimates that 110 were mentally defective, 83 intemperate and 171 industrious. Some members of the family had emigrated to a different section of the country, but the changed environment seemed to lead to no improvement so long as members of the old stock intermarried. Improvement of the old stock took place by out-breeding into better stocks. Estabrook feels that the outstanding characteristic of the family is feeblemindedness, although many individuals do not show that degree of mental defect which at present is supposed to require custodial care.

This work of Dugdale stimulated many other workers, so that we have today numerous family-history studies showing the inheritance of all sorts of mental and physical characteristics. For our purpose we need only mention some of the studies showing the inheritance of intelligence or lack of intelligence. Goddard's (14) study of the Kallikak family is one of the most interesting of these. Beginning with a feebleminded girl in an institution for mental defectives the family tree was traced back to the time of the Revolution. Here we find the illegitimate mating of a normal man with a feebleminded woman leading to a long line of feebleminded individuals. A later, legitimate mating of the same man with a woman of superior intelligence leads to a long line of highly intelligent and more or less eminent individuals.

Goddard (14) also presents the family histories of 327 feebleminded cases. The evidence here presented for the inheritance of feeblemindedness is very impressive. As Goddard says, "One hundred sixty-four or 54 per cent of the remaining 300 histories show other feebleminded persons in such numbers or in such relation to the individual case studied as to leave no doubt of the hereditary character of the mental defect. In these cases it is evident from the charts themselves that we are dealing with a condition of mind or brain which is transmitted as regularly and surely as color of hair or eyes. Thirty-four cases, 11.3 per cent, have been grouped under the head of Probably Hereditary. The charts of these, while not showing so certainly as in the former group the hereditary nature of the trouble, yet have a high degree of probability and may be considered hereditary."

The type of family-history study represented by Goddard's work has been repeated by numerous workers. In a study of one thousand cases of young repeated offenders Spaulding and Healy (14) show the inheritance of mental and physical defects, but find no evidence of the inheritance of criminalistic traits as such. The mental make-up of families containing congenitally deaf children was studied by Pintner and Osborn (19) Altogether 520 individuals were included. As many individuals as possible were given intelligence tests and the results of such tests revealed a large percentage of poor intelligence.

The Mathematical Method. — The use of the coefficient of correlation to express the amount of resemblance in any trait among related individuals offers a simple and valuable measure for the study of heredity. If the coefficient is low and approaches zero, there is no

resemblance in the trait in question among the individuals compared. Chance pairs of unrelated individuals show zero correlations for psychological traits, because there is no factor at work making for a resemblance among such chance selections of individuals. If, now, there is a greater resemblance among related than among unrelated individuals, this will show itself in the higher correlation among the related individuals. And we find such higher correlations among related individuals. This does not constitute a proof that heredity is the factor causing the resemblance, but, since the two groups are the same in every respect except in the matter of relationship or non-relationship, it would seem that the factor of heredity is the cause of the resemblance.

Pearson (04) gives the following correlations for certain physical traits:

Color of Eyes	Brothers	52
Height	Brothers	50
Height	Father and Son	30
Cephalic Index	Brothers	49
Color of Hair	Brothers	55

For certain mental characteristics we have the following correlations:

	Brothers	*Sisters*	*Brother and Sister*
Vivacity	47	43	49
Self-assertiveness	53	44	52
Introspection	59	47	63
Popularity	50	57	49
Conscientiousness	59	64	63
Temper	51	49	51

Ability	46	47	44
Handwriting	53	56	48
Average	52	51	52

With reference to deafness, Schuster (05) finds the resemblance between fathers and children to vary from .46 to .62, and between mothers and children from .45 to .62. Earle (03) found the correlation between children of the same family for spelling to be .50. Starch (17) gave educational and psychological tests to 18 pairs of adult siblings who were university students. The average of 15 correlations for the educational tests is 42. The four psychological tests give an average coefficient of 38. "The resemblance of siblings is apparently no greater in those mental traits which are directly affected by school work than in those which are not so affected. This seems to indicate that the mental similarities of children of the same parents are due primarily to heredity rather than to similarity of environment, since the resemblance is no greater in those traits which are more directly affected by environment."

Pintner (18), using a combination of six mental tests, found the following coefficients of association (Yule's Q) for siblings and non-siblings:

	Q	*No. of pairs*
School A	47	91
School B	28	89
Both schools	39	180
Chance selection of non-siblings	14	151
Another chance selection of non-siblings	19	300

The Pearson coefficient for 180 pairs of siblings is 22.

One of the most important studies in this connection is Thorndike's (05) work on twins. Fifty pairs of twins show the following coefficients for several tests:

Cancellation of A's	69
Cancellation of a-t and r-e	71
Misspelled words	80
Addition	75
Multiplication	84
Opposites	90

These resemblances are about twice those found for ordinary siblings:

	Twins	*Siblings*
A Test	69	32
a-t and r-e tests	71	29
Opposites	90	30

Furthermore older twins show no closer resemblance than younger twins:

	Younger Twins	*Older Twins*
A Test	66	73
a-t and e-r tests	81	62
Misspelled words	76	74
Addition	90	54
Multiplication	91	69
Opposites	96	88
Average	83	70

A longer period of similar environment does not tend to make the older twins more alike. In summing up this work Thorndike (14) says, "The facts are then

easily, simply and completely explained by one simple hypothesis: namely, that the natures of the germ cells, the conditions of conception, cause whatever similarities and differences exist in the original natures of men, that these conditions influence body and mind equally, and that in life the differences in modification of body and mind produced by such differences as obtain between the environments of present-day New York City public school children are slight."

From a number of correlations between parents and children Pearson (10) represents the strength of nature by a coefficient of correlation of 51, as compared with a coefficient of 03 as representing the strength of nurture. He says: "I think it quite safe to say that the influence of environment is not one fifth that of heredity, and quite possibly not one tenth of it."

Social Status. — Indirectly the factor of heredity can be seen at work in the differences in intelligence found among children of different social status. In the long run those possessing superior intelligence will in general tend to occupy the higher types of positions in the world, and those possessing inferior intelligence will gravitate towards the lower occupations. Since children tend to inherit the same kind of intelligence as their parents, we ought to find differences in the intelligence of children as we proceed from the lower to the higher occupations of their parents. The results of many workers show this to be the case.

In a total of 548 children Pressey and Ralston (19) found the following percentages scoring above the group median:

Occupational Group	*Percentage*
Professional	85
Executive	68
Artisan	41
Laborer	39

The rank of the professional groups is much the same in the report of Bridges and Coler (17), covering about 300 children tested by the Yerkes-Bridges Point scale:

Occupational Group	*Average C. M. A.*
Professional	1.42
Traveling Salesmen	1.26
Proprietors, etc.	1.21
Skilled	1.12
Unskilled	.83

The classification of high school seniors by Book (22) shows a similar ranking of occupations. Below are shown the percentages of seniors making scores above the state median:

	Per Cent Above Median	*Per Cent Very high scores*	*Per Cent Very low scores*
Professional	60	4.4	1.3
Clerical	60	2.4	...
Salesmen	56	2.8	0.3
Artisans	55	2.3	0.8
Executives	54	3.0	1.0
Day Laborers	47	0.4	1.2
Farmers	43	1.5	1.7

The percentages of very high and very low scores show that these may be found in all occupational groups. The relatively large percentage of very low scores in

the professional group is probably due to the tendency of this group to insist on the children going to high school and college in spite of mediocre mentality.

Terman's (19) 59 superior children have fathers who all belong in the first three classes of Taussig's five-fold occupational grouping. English (17) compared middle class with lower class children and found that 65 per cent of the lower group fell below the median of the total group. There are several other reports showing the same general trend.

We must remember, of course, that the occupational status of an individual is by no means a sure guide to his mentality. It is only in a general sense that occupational status correlates with mental ability. The distribution of children in all occupational groups runs from very low to very high intelligence. Since it is the duty of education to make the most of all the mental ability of all the pupils, educational classification according to social status is not justified. The brighter children in the lower social groups should be given just as much opportunity as they can profit by. The road through high school and college should be open to all who have the intelligence and the interest to travel along it.

Race Mixtures. — The results of the inheritance of general intelligence seem also to appear in a general way in tests of mulattoes and pure negroes. If colored subjects are classified according to skin color, the intelligence of the lighter negroes is superior to that of the darker negroes. The greater the mixture of white blood, the higher the intelligence of the group becomes. Thus Ferguson (21), summarizing the army results, says, "a summary of the test results indicates that roughly 20

per cent of the pure negroes, 25 per cent of the negroes three-fourths pure, 30 per cent of the true mulattoes and 35 per cent of the quadroons equal or exceed the average score of comparable whites." A rougher classification into two groups, lighter and darker, gives the same results. "The lighter class contained those whose color indicated that they were true mulattoes or persons of a larger proportion of white blood than true mulattoes. The darker class contained pure negroes and those whose skin color indicated that they had a smaller proportion of white blood than true mulattoes. The classification was made by the various examiners of the groups. In Alpha the lighter negroes obtained a median score of 50; the darker obtained a median of 30. In Beta, the lighter negroes obtained a median score of 36; the darker obtained a median of 29." Similar facts are also shown by Ferguson (16) with reference to negro children in Virginia when tested by several mental tests. When classified into four groups according to skin color, he found that the average scores on the tests increased from the darkest up to the lightest groups.

Garth (21, 22) has shown the general superiority of mixed to full blood Indians on several mental tests. The mixed blood group is 11 per cent better than the full blood group in performing tests of higher mental processes. The difference in performance between the mixed and full bloods does not seem to be so marked or so clearly defined as is the case with the light and dark negroes. Garth is not sure whether we have here a racial difference or merely a difference due to nurture.

The Indian has also been studied by Hunter (22), who shows that the ability involved in the Otis test de-

creases with a decrease in the amount of white blood. A gradual decrease in ability from the quarter to the full blood is shown on the intelligence test scores as follows:

	¼ Blood	*½ Blood*	*¾ Blood*	*Full Blood*
25 Percentile	77	68	56	36
Median	109	91	78	67
75 Percentile	128	118	108	94

In the case of the negro and, perhaps, in the case of the Indian we have a race of inferior intelligence as measured by our present intelligence tests when compared with American whites. The greater the amount of white blood entering into the various mixtures of the two races the greater is the intelligence of the resulting progeny, and this takes place because of the inheritance of mental ability.

Summary. — Although the belief in the inheritance of mental ability may be old, it is only during the last century that we have accumulated scientific evidence of importance. This evidence takes the form of family-history investigations and measures of amount of resemblance between related individuals. All sorts of mental traits as well as that complex of traits called general intelligence, are inherited in the same way as purely physical traits. The potency of environment is not nearly so great as is commonly supposed. Intelligence tests have done much to show that all children are not created free and equal with respect to their mental abilities. A child's abilities are determined by his ancestors, and all that environment can do is to give opportunity for the development of his potentiali-

ties. It cannot create new powers or additional abilities. This, then, is the main function of education, to measure the inherited capacities of the child and to so arrange the environment as to give full opportunity for all these capacities to develop to the uttermost.

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